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QUARTERLY REPORT NO. 1

(July 1, 1968, to October 1, 1968)

A DEMONSTRATION OF THE APPLICATION OF TECHNOLOGY  
TRANSFER TECHNIQUES TO TWO CONTRASTING REGIONAL INDUSTRIES

By

HARRY L. STILTZ, PROJECT DIRECTOR

For

UNITED STATES DEPARTMENT OF COMMERCE

OFFICE OF STATE TECHNICAL SERVICES

GRANT NO. 1310-001

A joint project with the  
Industrial Extension Service  
School of Engineering  
North Carolina State University

GEORGIA INSTITUTE OF TECHNOLOGY, ENGINEERING EXPERIMENT STATION  
INDUSTRIAL DEVELOPMENT DIVISION  
PROJECT NO. B-343

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## Background

In June 1968, the office of State Technical Services, U. S. Department of Commerce, awarded grants totaling \$123,431, to be matched equally by state funds, to the Industrial Development Division (IDD) of the Georgia Institute of Technology and the Industrial Extension Service (IES) of North Carolina State University for a two-year joint Special Merit Project, effective July 1, 1968. The purpose of the program is to demonstrate the application of technology transfer techniques to two contrasting regional industries. In North Carolina, the upholstered furniture industry, a traditional industry with a reputation for being relatively slow to take advantage of technological change, was selected. In Georgia, the mobile home industry, an emerging industry generally considered to be technically advanced and receptive to innovation, was chosen.

## Objectives

The overall objectives of the joint program are to identify the most effective methods of technology transfer and to determine whether they differ for traditional and emerging types of industry.

Objectives of the Georgia Tech segment of the program (OSTS Grant No. 1310-001) are as follows:

1. To identify new technology appropriate to the mobile home industry within the state of Georgia, and to effectuate the transfer of that technology by various techniques.
2. To evaluate the relative effectiveness of the various techniques of technology transfer.

## Plan of Procedure

The first month of activity was devoted to developing a Plan of Procedure which was submitted on August 1, 1968. The plan sets forth a detailed schedule of activity, divided into three phases, for the first year and includes a short section which discusses the procedure to be used during the second year. (The Plan of Procedure is attached as Appendix 1.)

Activities scheduled for the first year fall into the following three phases:

Phase I - Planning (July 1 - September 30, 1968). This phase covers initial planning, including joint planning with North Carolina State personnel and IDD branch office staff. Other activities include: (1) selection of "contact" companies (a small group of companies with whom the "in-depth" study will be conducted); (2) participation in the first annual convention of the Southeastern Mobile Housing Institute (SEMHI); (3) preparation of guidelines for IDD field personnel; (4) a search for new technology appropriate to the industries involved and to the objectives of the project; (5) personal visits to the contact companies to explain the project; (6) selection of the first new technology to be transferred; and (7) coordination of the first new technology transfer with North Carolina State.

Phase II - Technology Transfer and Evaluation (October 1, 1968 - February 28, 1969). Two technologies will be chosen for transfer during this period, the second more "difficult" than the first. Actual technology transfer will be handled by personnel of IDD's branch offices at Albany and Douglas, with assistance of the project director as required. Three transfer techniques will be used: (1) group presentations, (2) transfer by written materials, and (3) direct personal transfer and in-plant assistance. An approximately equal number of companies will be assisted by each technique.

IDD field personnel will follow up each transfer by personal visits, letters, telephone calls, and other appropriate means throughout the transfer period. At the end of each transfer period, the results will be evaluated, an oral presentation will be given to interested IDD staff members, and all pertinent data will be released to the entire mobile home industry.

Phase III - Technology Transfer and Evaluation (March 1 - June 30, 1969). A composite study of results obtained from the first two transfers will be made to determine the most effective transfer technique. This technique then will be used to transfer an advanced technology, one more "difficult" than the first two. The usual subsequent follow-up and evaluation procedures will be performed. An oral presentation covering the entire first year's progress then will be presented to the IDD staff and at North Carolina State.

Two activities will be carried out almost continuously throughout all three phases of the first year's work -- joint planning with North Carolina State and new technology search and study.

Second Year (July 1, 1969 - June 30, 1970). The first nine months of the second year of the project will consist primarily of repeating Phases II and III, with details of procedure dependent largely upon the first year's results. The last three months will be devoted to data analysis and report preparation.

#### First Quarter Activities

All work outlined for Phase I has been completed with the exception of writing a set of guidelines for use by field personnel during the first technology transfer. It was decided that with so many uncertainties, such as the response the group presentation will receive, the project director will originate the first group presentation (demonstration) and will accompany field personnel on at least one visit using the "direct personal transfer" technique. He also will prepare written material to be forwarded by each branch office to the contact companies.

Fifteen mobile home manufacturers and five furniture manufacturers have been selected from the initial lists as contact companies, and transfer of the first technology to these companies will be completed as scheduled for Phase II. In addition, selection of the second technology to be transferred prior to the end of the second quarter is well under way.

The first quarter has been devoted to procedures planning, advertising, coordination with North Carolina State University, coordination with Industrial Development Division (IDD) field personnel, visits to mobile home manufacturing plants in Georgia, participation in the Southeastern Mobile Housing Institute (SEMHI) Convention (see Appendix 2), attendance at the Man and His Shelter Conference at the National Bureau of Standards (see Appendix 3), selecting contact companies, gathering and studying literature on new technology, and making tentative plans for the first technology transfer.

The project director held meetings with IDD field personnel at Atlanta, Macon, Douglas, and Albany. All aspects of the project were discussed thoroughly, and each man is aware of the extent of his participation in the project. Maximum use will be made of personnel in the Douglas and Albany field offices since the majority of the contact companies are located in these areas.

Two meetings were held between representative groups from Georgia Tech and North Carolina State University, including Mr. Frank Clarke, Technical Services Section Head at IDD, Mr. John R. Hart, Industrial Extension Service

Supervisor at North Carolina State, and the two project directors. One meeting was held at the North Carolina State campus in July, and the other at Georgia Tech in September. These meetings were devoted to discussions of project procedures, types of technology, selection of contact companies, and other matters of project coordination.

Several meetings were also held with Mr. John B. Manley, Jr., Executive Vice President of the Southeastern Mobile Housing Institute, and Mr. Ed McGill, Executive Director of the Georgia Mobile Home Association. Both men have pledged their support for the project as evidenced in the SEMHI Convention report and SEMHI Newsletter excerpt which are made a part of this report.

During this quarter, the project director met with the IDD Technical Services Section Head at least once a week to discuss project status and to share views on project procedures. These meetings have proved valuable and will be continued throughout the project. Other IDD staff members have attended these meetings and have offered many suggestions that will benefit the project. Their direct participation will continue to be encouraged.

The project director has spent many hours reading articles on the subject of technology transfer and innovation during the past quarter, only to realize that many writers tend to think of new technology as some new invention created by a small group of people for limited usage. However, as has been explained in the many meetings held in connection with this project (as a means of gaining group participation), adaptation of an old idea into a new field is as helpful in achieving the goals of this project as the transfer of technology specifically invented for the project. As pointed out in the following discussion on planning activities, this project is being administered on the basis of transferring technology to the mobile home industry that is new to the industry but not necessarily a new invention. To borrow a phrase from Dr. Sumner Myers, Director, R & D Utilization Project; National Planning Association, "... there is still substantial time-lag between invention and its diffusion through the economy."

Results of project publicity have been excellent, and IDD has been assured of cooperation from the manufacturers, their associations, and from many companies in other industries. Representative samples of this publicity are attached as Appendix 4.

Much of the interest expressed in this project by outside groups has been a result of publicity released through Georgia Tech's Science News Service.

It is only natural to assume that more automation on the production line would alleviate this problem. However, our conversations with management personnel indicated that no appreciable amount of capital would be invested in automatic equipment without an assurance that the investment would be returned within a short time. This meant that any technology requiring capital expenditure would have to be supported by sufficient data to indicate a rapid return of investment if we were to obtain any appreciable success.

During our first technology transfer in October, we shall use this approach in introducing the use of "gang nails" as a laborsaving device. We have started a time and motion study on existing manual methods of fabricating mobile home roof trusses, and will complete this study early in October. A Miami manufacturer of gang nails has been contacted and has agreed to assist in this transfer. Although we have planned to concentrate our first technology on the automatic fabrication of roof trusses through use of gang nails and associated pneumatic equipment, our three methods of transfer (literature mailing, personal contact, and group presentation) will include information on how this technique can be applied to other areas of production. We propose to observe these other areas throughout the project and include this information in our final project analysis.

Other technology studies during the quarter involved an investigation of the possible uses of polyurethane and other plastics in mobile homes. These studies will be continued during the early part of Phase II.

Issue No. 194 of "Science and Technology Today," dated August 1, 1968, (copy included herein) was devoted exclusively to the Special Merit Project and was mailed to approximately 800 news media outlets. Reprints of the article have appeared in many local, state, and regional publications, and the article is scheduled for a future release in the national Mobile Home/Travel Trailer Dealer Magazine. A reprint that appeared in the September issue of the Southeastern Mobile Housing Institute Newsletter has been invaluable in solidifying manufacturers' interest in the project.

IDD's efforts to accumulate data on the mobile home industry in the course of determining those areas wherein a technology transfer would be most beneficial also has increased public awareness of the project. However, this has brought with it a continuous request for information from many sources, including land developers, prospective mobile home manufactures, investors, bankers, and others. In many instances, these contacts have resulted in exchanges of information that are beneficial to the project's goals, whereas in other instances, it was felt that the requests fell outside the scope of this project. IDD will continue to work closely with these interested groups, but will endeavor to separate them into categories of project participation or normal State Technical Services.

During our visits to mobile home manufacturing plants throughout Georgia, we have been cordially welcomed by top management and have been given an opportunity to inspect many plants. This latter statement is noteworthy because of the difficulty encountered by many others who have attempted to visit these plants. Most manufacturers feel that many of their manufacturing techniques are proprietary, and they have been assured by project personnel that such proprietary information will not be divulged at other plants.

One of the biggest problems we discovered in most plants was a shortage of personnel coupled with an increasing backlog of work and a need for increased production. We, therefore, concentrated our technology search in those areas that would partially eliminate a need for increased manpower while simultaneously increasing production.

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QUARTERLY REPORT NO. 2 (October 1, 1968 to December 31, 1968)

A DEMONSTRATION OF THE APPLICATION OF TECHNOLOGY  
TRANSFER TECHNIQUES TO TWO CONTRASTING REGIONAL INDUSTRIES

A joint project with the Industrial Extension Service  
School of Engineering, North Carolina State University

Prepared for  
OFFICE OF STATE TECHNICAL SERVICES  
U. S. DEPARTMENT OF COMMERCE

by: Harry L. Stiltz, Project Director  
INDUSTRIAL DEVELOPMENT DIVISION

Georgia Tech Project B-343  
OSTS Grant No. 1310-001

1969



Engineering Experiment Station  
GEORGIA INSTITUTE OF TECHNOLOGY  
Atlanta, Georgia

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## I. BACKGROUND

In June 1968, the office of State Technical Services, U. S. Department of Commerce, awarded grants totaling \$123,431, to be matched equally by state funds, to the Industrial Development Division (IDD) of the Georgia Institute of Technology and the Industrial Extension Service (IES) of North Carolina State University for a two-year joint Special Merit Project, effective July 1, 1968. The purpose of the program is to demonstrate the application of technology transfer techniques to two contrasting regional industries. In North Carolina, the upholstered furniture industry, a traditional industry with a reputation for being relatively slow to take advantage of technological change, was selected. In Georgia, the mobile home industry, an emerging industry generally considered to be technically advanced and receptive to innovation, was chosen.

## II. OBJECTIVES

The overall objectives of the joint programs are to identify the most effective methods of technology transfer and to determine whether they differ for traditional and emerging types of industry.

Objectives of the Georgia Tech segment of the program (OSTS Grant No. 1310-001) are as follows:

- I. To identify new technology appropriate to the mobile home industry within the state of Georgia, and to effectuate the transfer of that technology by various techniques.
2. To evaluate the relative effectiveness of the various techniques of technology transfer.

### III. BACKGROUND ON QUARTERLY REPORT NO. 1

Quarterly Report No. 1 was submitted in October, 1968. This report covered all activities through September, 1968, and contained the following information:

#### A. Plan of Procedure

This was a detailed plan of procedure covering the entire project and including a schedule of activities.

#### B. First Quarter Activities

This section covered preliminary planning activities, initial contacts with the mobile home manufacturers, and a discussion of how our first technology was selected. It also included a discussion of how the first technology transfer would be accomplished during the second quarter.

### IV. INTRUDUCTION TO QUARTERLY REPORT NO. 2

Due to the number of special reports and other documents that have accumulated during the second quarter of the project, this report will consist primarily of copies of those documents and a brief synopsis of each.

Each of the following sections will summarize and comment on a specific document contained in the appendix.

### V. FIRST TECHNOLOGY TRANSFER REPORT-MOBILE HOMES INDUSTRY

This report covers all activities of our first technology transfer from "preliminary planning" through "evaluation of each of the three transfer techniques". It is complete with photos, list of attendees at the group presentation, newspaper articles etc.

The report concludes that our originally scheduled six-week evaluation period is much too short due primarily to the rapid growth of this industry. A preliminary evaluation is presented, but a detailed conclusion of results is postponed to a later period.

VI. MEMORANDUM (NOV. 7, 1968)-GUIDELINES

This memorandum was addressed to the two Georgia Tech Industrial Development Division (IDD) branch offices in whose territory our contact mobile home manufacturers are located. It's purpose was to provide guidelines and other pertinent information on the first two technology transfers. It is only one of several similar memorandums but is included herein to show the type of information flow that is necessary between the project director and field personnel. These memorandums are intended for IDD internal usage only, so they often contain information that is not disseminated to the contact companies.

VII. SECOND TECHNOLOGY TRANSFER

Our second technology transfer was completed during the month of December but no follow-up visits were made during the second quarter. As shown on our original schedule, follow-up and evaluation will not be completed until mid-way in the third quarter. At that time a detailed report will be prepared and will be included in the third quarterly report.

A. Invitation to Demonstration (Group Presentation)

This document is a standard "Technology from Tech" note that we use in all correspondence with our contact companies. In this particular note we were inviting various contact companies and individuals to a demonstration of our second technology, "Urethane Foam Sprayed-In-Place Insulation". The "Technology from Tech" cover sheet contains the invitation, and the remainder of the document contains technical data pointing out the advantages of rigid urethane foam insulation for mobile homes.

B. List of Attendees

This list shows that twenty-six persons attended the demonstration and that ten of those were representatives of the nine mobile homes manufacturers to whom invitations were extended. These ten men represented five of the nine invited companies (Marlette, Redman, Cullip, Bright Leaf Corp., and Conner Industries).

It is interesting to note that two attendees represented the United States Department of Agriculture, Forest Service. These men were invited because of their past and present research activities in the use of urethane in housing. Mr. Richard F. Blomquist, Project Leader, Housing Research, discussed some of those activities with the group.

Also represented were two insurance companies, Insurance Company of North America and Foremost Insurance Company. Both companies are actively engaged in insuring mobile homes and they were invited to send representatives to see first-hand the fire retardant properties of urethane foam.

The Georgia Power Company representative was present to gather additional technical data on urethane foam insulation in total electric mobile homes.

As in our previous demonstration, we again invited representatives from the Americus, Georgia, Chamber of Commerce and the West Central Georgia Area Planning and Development Commission.

C. Written and Direct Personal Transfers

Only the "Technology from Tech" front sheet from the "written" and "direct personal" transfer documents is included herein since the remainder of the document is identical to that in the "group presentation".



Identical documents were mailed for the "written" transfer and hand-carried for the "direct personal" transfer.

#### VIII. SEMHI RESEARCH COMMITTEE

On October 18, 1968, the project director was invited to attend the first meeting of the Southeastern Mobile Housing Institute Research Committee. This committee was established to provide research in both mobile and modular (factory manufactured) housing for member companies.

The first meeting was attended by representatives of many organizations and was intended as a formulative meeting wherein objectives would be established. During that meeting it was difficult to determine if the project director should accept membership on the committee. However, at the second meeting it was readily apparent that such membership would not fall within the scope of this project. A report of the second meeting and a notice of the third meeting is included herein.

It should be noted that the invitation to attend the first meeting was an outgrowth of our association with SEMHI through activities within the technology transfer project. This, in turn, has resulted in active committee participation by two staff members of Georgia Tech.

#### IX. TRIP REPORT - AUTOMATED BUILDING COMPONENTS, INC.

At the invitation of Automated Building Components, Inc., in Miami, Florida, the project director visited their plant on November 1, 1968, to determine if there would be additional technology applicable to the mobile homes industry from this source (This was the company that assisted with the first technology transfer). A report of that visit is included herein.

As noted in the latter part of the report, the company requested assistance from Georgia Tech in developing a modular (low-cost) home division. This assistance was rendered by IDD's Technical Services Branch and has resulted in the company forming a modular home division to initially

supply approximately 1,000 low-cost homes in the Dalton, Georgia, area.

X. SEMHI NEWSLETTER RELEASE

Included herein is a letter dated December 4, 1968, addressed to Mr. John B. Manley, Jr., Executive Vice President of SEMHI requesting that they include the accompanying "SEMHI Reports on Technology from Tech: notice in their next SEMHI Newsletter. This newsletter is a monthly publication distributed to all SEMHI members in six southeastern states.

Mr. Manley advised the project director by telephone that they would be happy to provide one page in their next issue. A camera-ready copy was provided and it is anticipated that the release will appear in the January, 1969, issue.

XI. NEWS RELEASES

Four important project news articles appeared during the second quarter. The most noteworthy of these was an article describing the project which appeared in the "Mobile Home/Travel Trailer Dealer Magazine," a national publication. Even more important is the fact that the issue in which the article appeared is the Thirteenth Annual Directory and Buyer's Guide which means that most recipients will keep this issue on hand for a year thereby giving the project additional exposure.

The other three articles appeared in the "Americus Times-Recorder"; one covering the first technology transfer demonstration, and the other two covering the "before and after" information on the second technology transfer demonstration..

XII. CORRESPONDENCE

Included herein are copies of correspondence received during the second quarter requesting information on project activities and offering assistance.

This correspondence represents only a small fraction of outside interest in the project since many contacts are made by personal visits and telephone calls to the project director.

### XIII. CONCLUSIONS

The project is currently on schedule and it appears that our original schedule will be maintained throughout the remainder of the project.

Interests in the project from outside sources continues to grow and continues to reflect a widespread interest in low-cost factory manufactured (modular) housing. The project director has continually transferred all contacts regarding modular housing to IDD's Research Services Branch and as a result, plans are under way at Georgia Tech to establish a Housing Resources Center.

Activities during the third quarter will consist primarily of follow-up and evaluation of the first two technology transfers, selection of a technology for transfer during the early part of the fourth quarter, report preparation on the second technology transfer, and a coordination meeting at North Carolina State University in January, 1969.



FIRST TECHNOLOGY TRANSFER REPORT

MOBILE HOMES INDUSTRY

FIRST TECHNOLOGY TRANSFER REPORT

MOBILE HOMES INDUSTRY

SPECIAL MERIT PROJECT - A DEMONSTRATION  
OF THE APPLICATION OF TECHNOLOGY TRANSFER  
TECHNIQUES TO TWO CONTRASTING REGIONAL INDUSTRIES

UNITED STATES DEPARTMENT OF COMMERCE  
OFFICE OF STATE TECHNICAL SERVICES  
GRANT NO. 1310-001

A joint project with  
the Industrial Extension Services  
School of Engineering, North Carolina State University  
working in the Upholstered Furniture Industry

by  
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FIRST TECHNOLOGY TRANSFER

"Automating Construction by Gang-Nail Assembly Techniques"

I. SUMMARY

The first technology transfer on this project began with a demonstration of automatic roof truss fabrication in mobile home construction using Gang-Nails and a Multi-Head Press, at Americus, Georgia on October 22, 1968 (See Appendix A through F). The theme of this transfer was "Innovation through Automation" which was predicated on our previous findings that there was a critical shortage of manpower in the mobile homes manufacturing industry in the state of Georgia.

Although the transfer was started with a demonstration of automatic roof truss fabrication, this information was subsequently expanded to include fabrication of floor frames, fastening walls to floors, and installing interior wall paneling by the Gang-Nail technique. This additional technology transfer was in keeping with our theme of automation.

The initial transfer was accomplished by three techniques; group presentation, direct personal transfer, and transfer by written materials. This transfer was then supplemented with additional technical data as mentioned above, plus information on additional benefits to be derived from the use of Gang-Nails in mobile home construction. One such benefit was a possible cost reduction that could be accomplished through use of an automatic roof truss assembly. This had been determined by performing time and motion studies in several plants and by obtaining pricing data on materials from manufacturers and suppliers.

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Approximately three weeks after the initial transfer, a "Technology from Tech" note (Appendix G) outlining additional reasons for using Gang-Nail assembly techniques were mailed to all contact companies. These additional reasons were primarily based on meeting requirements of the new Georgia Rules and Regulations for Factory Manufactured Movable Homes that became effective on September 26, 1968.

We were advised at a meeting in the Georgia State Fire Marshal's Office on November 12, 1968, (this office is charged with responsibility of administering the new rules and regulations) that Georgia mobile home manufacturers would be given until January 1, 1969, to comply with the standards for construction, plumbing, heating and electrical systems contained in the rules and regulations. Our study of these new standards showed that most of our contact companies were not in compliance, so we decided that each technology transferred should be studied on the basis of its contribution to compliance with the standards.

At approximately two-week intervals Georgia Tech's Industrial Development Division personnel contacted each company to determine if any action had been taken on the technology transferred. This information was then compiled and evaluated by the project director.

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## II. Preliminary Planning

Sixteen mobile home manufacturing companies, representing about one-third of the companies in Georgia, were selected as contact companies. Each plant was visited by an IDD staff member and each member was given a tour through at least one plant. Subsequent visits were made to a few of the most receptive companies for the purpose of studying production techniques in detail and discussing problem areas with top management.

While we were determining an area in which to concentrate our first technology search, management in the majority of plants agreed that their most pressing problem was a shortage of employees coupled with an increasing back-log of orders. We therefore concentrated our search in the area of labor saving techniques.

We concentrated our efforts on studying existing production techniques and discovered that management in most plants operated on the assumption that all "scrap" materials should be used to the fullest extent possible. Realizing that this philosophy could result in savings in material at the expense of increased manpower, we directed our observations to those areas where scrap materials were being utilized. We found that the majority of scrap materials consisted of interior plywood paneling and exterior aluminum siding left over from window and door cut-outs. We further found that the plywood scrap was cut into small sections and used primarily as structural braces in roof trusses, and the aluminum scrap was cut into narrow strips

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that were used for splicing floor joists and for attaching exterior walls to the floor.

A study of these assembly areas (which included time and motion studies in several plants) indicated that a reduction in manpower and an increase in product quality could be accomplished by discarding the scrap material and adopting a system of Gang-Nail assembly techniques. Gang-Nails are produced in many types and have been in use in the conventional construction industry for several years. One type designated "heel connector" consists of a flat piece of steel that has been punched in such a manner as to leave one side smooth and the other side covered with multiple prongs that simulate a "gang of nails" (see Appencix D). This type is normally used to join two or more pieces of wood and was considered as a replacement for the scrap aluminum strips. Another type designated "strut nail" contains prongs at both ends and a smooth center section that has been formed into a "U" shaped channel (see Appendix E). This Gang-Nail will join two pieces of wood separated from each other by a distance equal to the length of the "U" shaped channel, and was considered to be a ready replacement for the scrap plywood braces.

The project director contacted Automated Building Components, Inc. whose president invented the Gang-Nail, and requested additional data on types of nails and assembly techniques. The company provided the requested data and agreed to furnish a Bowstring Multihead Press (see Appendix F) for a demonstration during our group presentation transfer.

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This press had been designed and developed by the company specifically for automatic assembly of mobile home roof trusses. They also agreed to furnish technical literature and sample Gang-Nails for our other two types of transfer.

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### III. Transfer by Three Techniques

#### A. Group Presentation

The group presentation technology transfer technique was accomplished by inviting a selected group of contact companies (see Appendix J) to an oral presentation and demonstration of a Gang-Nail System of mobile home roof truss fabrication. Nine companies were invited and four responded by sending a total of nine representatives.

A total of nineteen persons (see Appendix K) were in attendance representing Georgia Tech, West Central Georgia Area Planning and Development Commission, Oakwood Trailer Sales (Greensboro, N.C.), Automated Building Components, Inc., Americus Chamber of Commerce, and the mobile home manufacturers.

The presentation was preceded by a free lunch served in the assembly room of the Sumter County Electric Membership Corporation in Americus, Georgia, through the courtesy of Automated Building Components, Inc. Following lunch, short talks were given by the project director and the ABC, Inc., representative on the theme of the demonstration "Innovation through Automation." The project director pointed out that the Gang-Nail System for automatic roof truss fabrication was merely one step in automation possible with this technology. He also pointed out other areas in which the system would provide automation as well as increased quality, such as floor framing assembly and wall-to-floor assembly.

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During the demonstration approximately twenty-five roof trusses were assembled at an average time of fifty seconds each. This time was less than had been observed in many plants by as much as one minute to as little as ten seconds. Assuming a rate of 400 trusses per day (8 - 60' mobile homes) the man-hour savings would range from 8 to 48 hours per week. Since there are presently fifty mobile home plants in Georgia the man-hour savings for the industry in this state would average between 400 and 2,400 or approximately 1,000 man-hours per week. Although this figure alone would not be too impressive, we must realize that we are only discussing automation of one small component of the entire unit.

In addition to the possible man-hour savings, it was demonstrated that the Gang-Nail assembled trusses were consistent in quality whereas the plywood and glue type varied. It was pointed out to the group that this feature of consistent quality is important in meeting state construction standards and is readily attainable through automatic assembly techniques.

All representatives of the manufacturers stated at the end of the demonstration that they were impressed and were looking forward to the next technology transfer. They all agreed that whether or not they adopted the Gang-Nail approach they would certainly start taking a closer look at possible areas of automation in their plants.

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Movie films of the demonstration were made available to all mobile home manufacturers through the various trade associations, but no evaluation will be made of their effectiveness except through a random sampling later in the project. The primary purpose of these films was to enhance our relationship with the associations and to minimize the possibility of some companies feeling they had been excluded from the project.

An evaluation of the effectiveness of the group presentation transfer was accomplished by follow-up visits at each plant at two-week intervals.

B. Direct Personal Transfer

A "Technology from Tech" note entitled "Innovation through Automation" (see Appendix L) was prepared for use in the direct personal transfer and the transfer by written materials. It was decided that both types of transfer would be accomplished after the group presentation so that IDD personnel would be more familiar with the technology after having witnessed the demonstration.

Five mobile home manufacturers were visited and each was given a "Technology from Tech" note, a Gang-Nail catalog and samples of Gang-Nails. Operation of the Multi-Head Press was explained and management was encouraged to consider automation in all assembly areas.

Again follow-up visits were made at two-week intervals.

C. Transfer by Written Materials

Four mobile home manufacturers were selected to receive new technology through transfer by written materials. Each company was sent a "Technology from Tech" note, a Gang-Nail catalog and some sample Gang-Nails. Follow-up on this technique was accomplished by telephone at two-week intervals.

Contd.

#### IV. Evaluation of Three Techniques

##### A. Evaluation Planning

During the initial planning of this project it was decided that the first transfer follow-up and evaluation period would extend for approximately six weeks. However, as work progressed, we found that most mobile home manufacturers were too busy with burgeoning orders to take immediate action on new technology. We then decided to temporarily close our evaluation of the first technology transfer after six weeks so we could concentrate on our second technology transfer.

Since the optimum evaluation period appears to be at least six months, the six-week results presented herein should not be considered as conclusive. Another report will be prepared after six months.

##### B. Evaluation of Group Presentation

Nine companies were invited to the Gang-Nail System demonstration and four attended for a total of 44% response. It was interesting to note that each of the four sent more than one representative, while the ones that did not attend used a heavy work schedule as their reason for not attending.

The following paragraphs classify each company in attendance by letter designation and describes action taken by each during the first six weeks:

###### Company (a):

This company was sufficiently impressed that they started gathering cost data on an automatic roof truss assembly system within two weeks.

The plant manager indicated he was primarily impressed with the con-

Contd.



sistent quality of the Gang-Nail truss and would probably start using this technology if his cost comparison was favorable.

At the end of six weeks all cost data had been assembled and forwarded to corporate headquarters in another state for evaluation.

Company (b):

This company decided within two weeks that they would continue using their present plywood/glue type system. They felt that their costs were comparable to the Gang-Nail technique and that their quality was sufficient to meet all standards.

Their plywood/glue system, however, is unlike that at most other plants since management in this company is more innovative than most and has developed an automatic plywood/glue system. This system operates similarly to the Gang-Nail system except that plywood braces are used in lieu of Gang-Nails.

Company (c):

Since we are transferring technology to an extremely cost-conscious industry, it was interesting to note that this company uses solid, shaped 2" x 6" rafters instead of less expensive roof trusses. They manufacture above average priced mobile homes and feel that the solid rafter adds quality.

The plant manager stated that he was impressed with the demonstration and would consider the Gang-Nail system over a plywood/glue system if they decided to use trusses in the future.

Contd.

Company (d):

This company contacted the Gang-Nail manufacturer immediately following the demonstration to obtain additional cost data. The president of the company stated that he thought they would start using this technology in the near future. However, at the end of the six-week evaluation period they had not progressed beyond a study phase.

C. Evaluation of Direct Personal Transfer

Two companies were selected for the direct personal transfer technique. This was a smaller sample than we will use on subsequent transfers but we felt that due to the simplicity of the Gang-Nail technology there wasn't much to be gained in visiting more companies. The written material and sample nails adequately explained the technique of Gang-Nail assembly.

One company indicated on our first visit that they felt their method of manufacturing roof trusses was more economical than the Gang-Nail method. At the end of six weeks they had not given any further thought to using the new technology in any phase of their operation.

The other company was quite interested in the presentation since they had become dissatisfied with their plywood/glue truss assembly. They also stated they had just recently started looking for ways to automate other assembly areas in an effort to reduce manpower and increase production. Their goal is to produce one mobile home per each five direct labor employees whereas the average appears to be in excess of ten employees. At the end of our first evaluation period they were still studying automation techniques but had not taken any direct action.

Contd.

D. Evaluation of Transfer by Written Materials

Five companies were selected to receive technology data by mail and the results of our initial evaluation are as follows:

Company (a)

This company uses a solid rafter in lieu of a roof truss and they plan to continue with this practice. However, we will continue to evaluate their consideration of the Gang-Nail assembly technology in other areas.

Company (b)

This company purchases completed roof trusses but indicated they would make a cost comparison as soon as time permitted. They were opening a new plant and had not had time to evaluate the data we mailed.

Company (c)

The evaluation of transfer effectiveness at this company was almost a duplicate of that at Company (b) except they were in the process of opening two new plants.

Company (d)

This company operates on a philosophy of purchasing as many pre-assembled components as possible and management stated that this philosophy would be continued unless they could see an appreciable cost reduction. They did not feel that the Gang-Nail system would offer enough cost reduction to warrant further investigation.

Company (e)

This company manufactures plywood/glue trusses but indicated they are taking a careful look at the Gang-Nail technology for all assembly areas. At the end of six weeks they had not made any decisions.

Contd.



## V. Conclusions

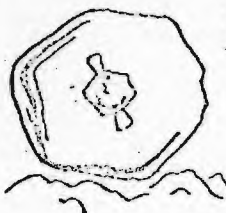
As stated earlier in this report, our conclusions presented herein should not be considered as final. They result from a six-week evaluation period as originally scheduled in our Plan of Procedure, and it was apparent during this six-week period that this industry would not take immediate action on any new technology introduced to them. We therefore propose to make subsequent evaluations of transfer effectiveness at six-month intervals for the duration of the project. We further propose to reserve the last six months of the project for statistical analysis and data preparation rather than the last three months as originally scheduled.

The mobile homes industry has experienced a rapid rate of growth in recent years and there appears to be no let-up in the near future. Thus the industry is faced with a need for more production capability which requires more plants, more experienced management personnel, increased efficiency, etc. As an indication of this growth, the number of mobile home manufacturing plants in the state of Georgia increased by about 25% during the first four months of this project.

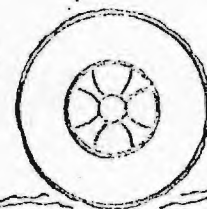
This rapid rate of growth has caused a serious shortage of trained management personnel which we feel is the greatest contributing factor to the slow rate of innovation within the industry. A new plant manager is reluctant to consider new technology at a time when he is still learning to cope with the problems of supervising all plant activities. Conversely, the more experienced plant managers are busy training and assisting new managers in opening new plants and don't have time to consider new technology.

The general attitude in this industry is "Don't rock the boat by making changes at a time when business is booming and profits are good." However, we expect to see a reversal of this attitude as new plant construction levels off, as new management personnel become more experienced and as competition increases. Subsequent evaluations will take these factors into consideration.

APPENDIX A



# TECHNOLOGY FROM TECH



INDUSTRIAL DEVELOPMENT DIVISION  
ENGINEERING EXPERIMENT STATION  
GEORGIA INSTITUTE OF TECHNOLOGY

1132 WEST PEACHTREE STREET, N.W., ATLANTA, GEORGIA 30309

Under a grant from the United States Department of Commerce, Office of State Technical Services, with matching funds from Georgia Tech, staff members of Tech's Industrial Development Division are working on a two-year project to transfer new technology to the mobile homes manufacturing industry.

HARRY L. STILTZ, PROJECT DIRECTOR

## OUR MESSAGE FOR TODAY

YOU ARE CORDIALLY INVITED TO ATTEND

A DEMONSTRATION OF THE GANG-NAIL \*

SYSTEM OF ROOF TRUSS FABRICATION

AT

THE SUMTER COUNTY ELECTRIC MEMBERSHIP CORPORATION

AMERICUS, GEORGIA

OCTOBER 22, 1968

AT 12:00 NOON

A free lunch will be served at 12:00 o'clock, followed by a demonstration of the Bowstring Multihead Press. This equipment has been furnished through the courtesy of Automated Building Components, Inc., Miami, Florida. Mr. Louis J. Ballantyne, Sales Manager of the Mobile Homes Division will be present to answer any questions.

ONE MAN - ONE MINUTE - ONE BOWSTRING TRUSS

I N N O V A T I O N    through    A U T O M A T I O N

\*Registered Trade Name - Automated Building Components, Inc.

APPENDIX B

MONDAY, OCTOBER 21, 1968 *Americian Times-Recorder*



THE GEORGIA TECH Industrial Division will stage a demonstration at Sumter Electric Membership Corp. Tuesday at noon to transfer information to the area mobile home manufacturers.

Louis J. Ballantyne of the Automotive Building Components, Inc., Miami, Fla., will present the demonstration on the gang nail system of truss fabrication. Managers in this area have been invited to the luncheon-demonstration.

APPENDIX C

LIST OF ATTENDEES AT GANG-NAIL MOBILE HOME ROOF TRUSS

DEMONSTRATION at AMERICUS, GEORGIA on OCTOBER 22, 1968

PROJECT B-343

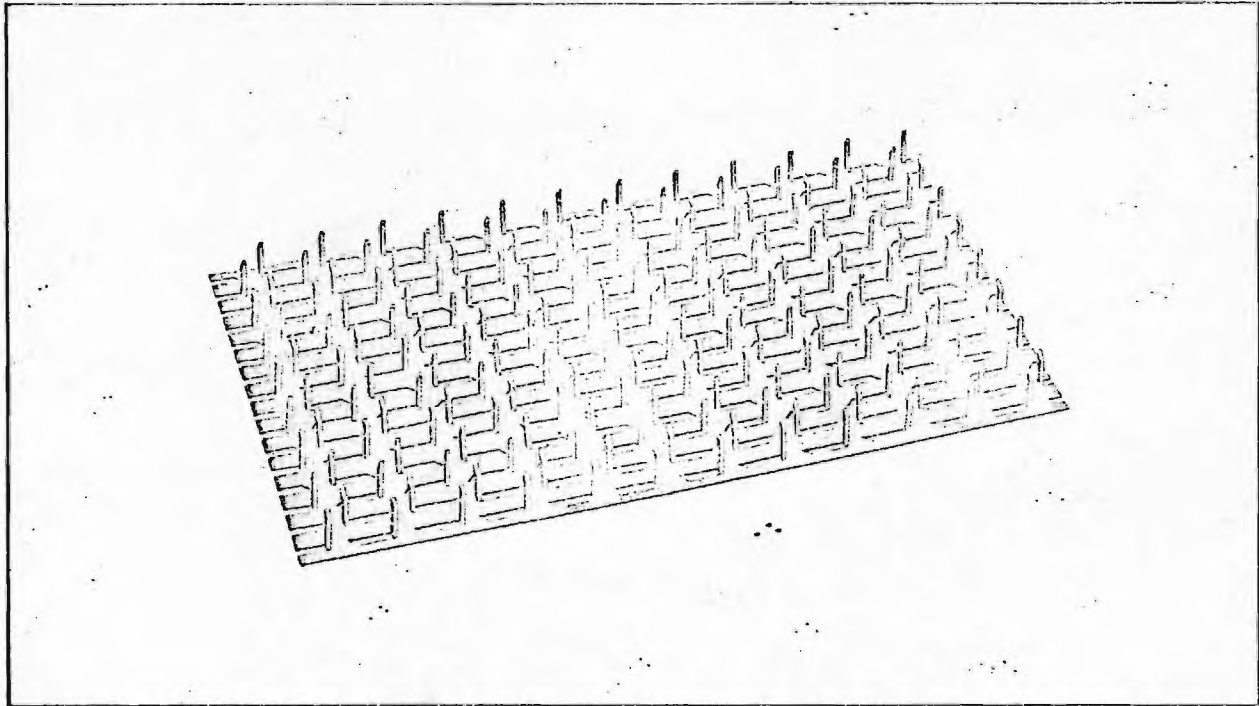
<u>NAME</u>	<u>REPRESENTING</u>	<u>LOCATION</u>
Miles Greer	Georgia Tech, IDD	Douglas, Georgia
O. M. Wellslager	Georgia Tech, IDD	Douglas, Georgia
H. A. Andrews, Jr.	Walker Mobile Homes	Rockwell, N.C.
Oliver Walker	Walker Mobile Homes	Rockwell, N.C.
Ralph L. Darling	Oakwood Trailer Sales	Greensboro, N.C.
Tom Holman	Marlette Homes, Inc.	Americus, Georgia
Art Davis	Marlette Homes, Inc.	Americus, Georgia
Bruce G. Parker	Marlette Homes, Inc.	Americus, Georgia
Eric A. Newsom, Jr.	Georgia Tech, IDD	Albany, Georgia
Frank Moore	West Central Ga. APDC	Ellaville, Georgia
J. P. Luther	Chamber of Commerce	Americus, Georgia
Lester Shewmake	Champion Homes	Ellaville, Georgia
Samuel Lee	Champion Homes	Ellaville, Georgia
Cecil Cullip	Cullip Industries Inc.	Ellaville, Georgia
Bob Watson	Cullip Industries Inc.	Ellaville, Georgia
Harry L. Stiltz	Georgia Tech IDD	Atlanta, Georgia
Bill Studstill	Georgia Tech IDD	Albany, Georgia
L. J. Ballantyne	"Gang-Nails"	Miami, Florida
Ben Sparks	"Gang-Nails"	Miami, Florida



## APPENDIX D



GANG-NAIL  
BOWSTRING TRUSS CONNECTORS



## 20 GAUGE HEEL CONNECTORS (Partial Listing)

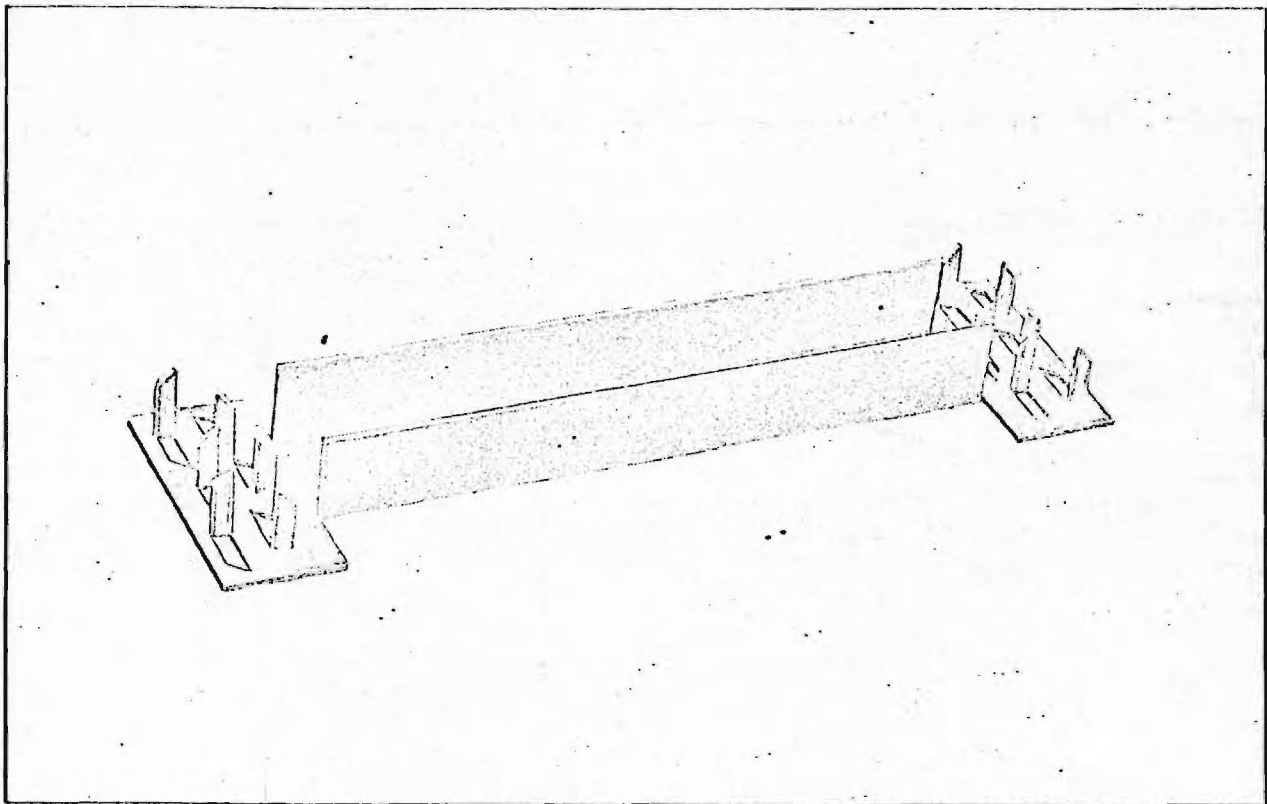
Size	Net Price Per Nail	No. Plates Per Box	Net Price Per Box
1 x 4.5	1.6¢	570	8.98
1 x 5.1	1.8¢	390	7.02
2 x 2.3	1.6¢	675	10.63
2 x 2.8	2.2¢	450	9.70
2 x 3.4	2.3¢	402	9.34
2 x 3.9	2.8¢	312	8.66
2 x 4.5	3.1¢	270	8.50
2 x 5.1	3.5¢	246	8.67

These prices for Gang-Nails for Mobile Homes are after allowances for trade and 5% prompt pay discounts, and plus a normal 2½% empty freight charge. An additional discount of 5%, with free delivery, for truck load purchases. 2½% empty freight charge does not apply to truck load lots.

## APPENDIX E



# GANG-NAIL BOWSTRING TRUSS CONNECTORS



## STRUT NAILS \*

Size	Net Price Per Nail	No. Plates Per Box	Net Price Per Box
1.5 x 2.6	3.0¢	450	13.35
1.5 x 3.9	3.8¢	300	11.44
1.5 x 4.5	4.3¢	320	13.83
1.5 x 7	6.2¢	200	12.37

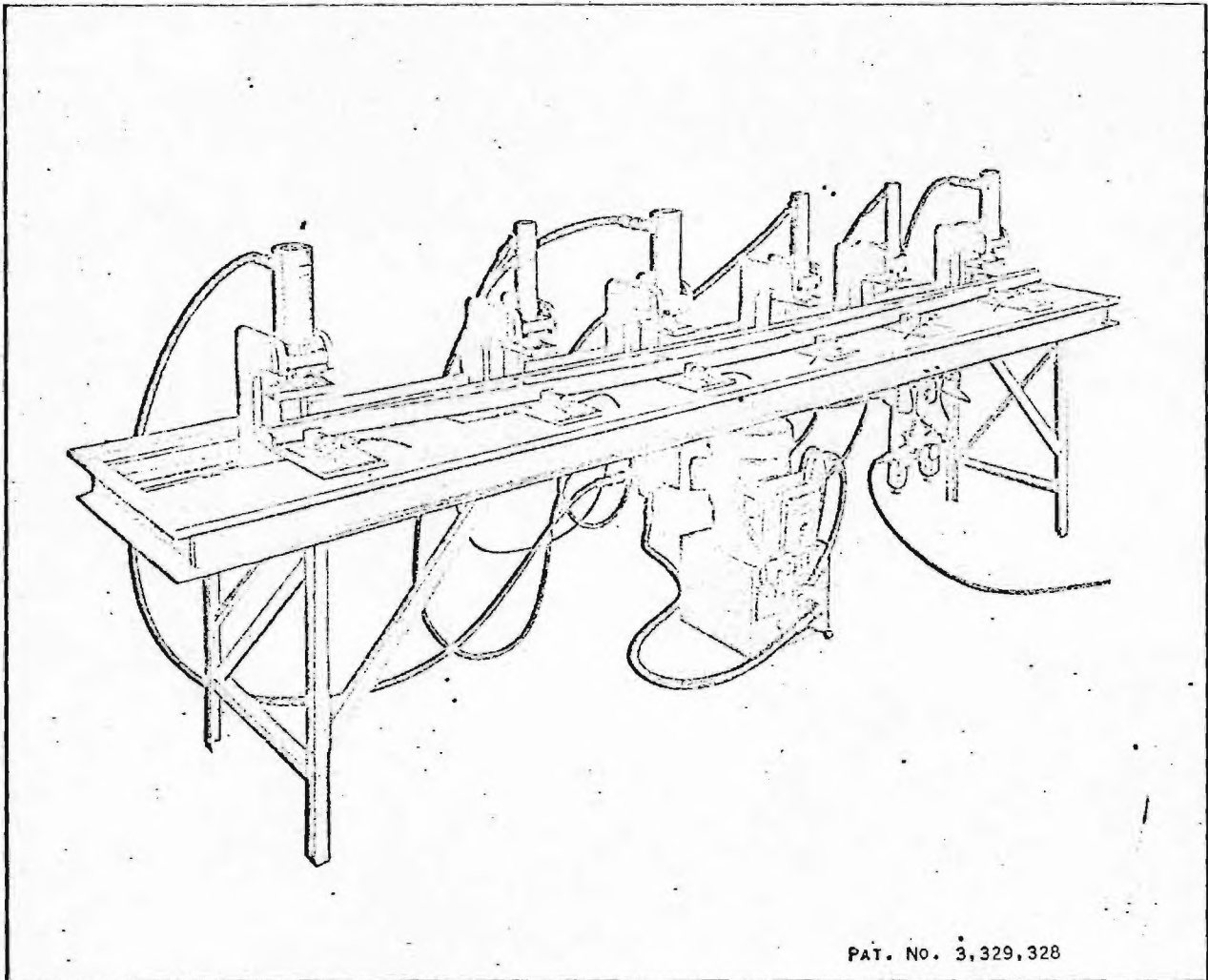
\* Reg. TM

These prices for Gang-Nails for Mobile Homes are after allowances for trade and 5% prompt pay discounts, and plus a normal 2½% empty freight charge. An additional discount of 5% with free delivery, for truck load purchases. 2½% empty freight charge does not apply to truck load lots.

APPENDIX F



BOWSTRING MULTIHEAD PRESS  
MODEL BR 7-6



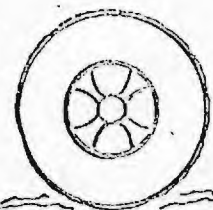
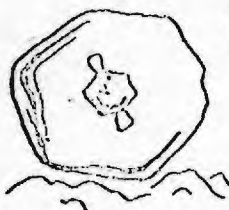
PAT. NO. 3,329,328

The One Man, One Minute Bowstring Truss Machine.  
New added capacity - to 9" rise bows. 10' or 12'  
wide, with minimum adjustment. Time proven power  
pac. Fast, efficient, economical bow production.



APPENDIX G

# TECHNOLOGY FROM TECH



INDUSTRIAL DEVELOPMENT DIVISION  
ENGINEERING EXPERIMENT STATION  
GEORGIA INSTITUTE OF TECHNOLOGY

1132 WEST PEACHTREE STREET, N.W., ATLANTA, GEORGIA 30309

Under a grant from the United States Department of Commerce, Office of State Technical Services, with matching funds from Georgia Tech, staff members of Tech's Industrial Development Division are working on a two-year project to transfer new technology to the mobile homes manufacturing industry.

HARRY L. STILTZ, PROJECT DIRECTOR

## OUR MESSAGE FOR TODAY

BE PREPARED FOR INSPECTORS  
FROM THE STATE FIRE MARSHAL'S OFFICE  
Study the New Rules and Regulations

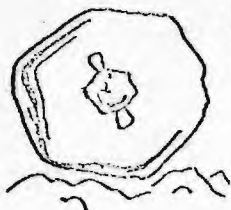
Re-review the recent information we gave you on automatic roof truss assembly through use of a Gang-Nail system. We stressed cost reduction over existing plywood, glue and staple assembly techniques. Now we would like to stress the advantage of consistent quality from truss to truss.

Ask yourself the following questions:

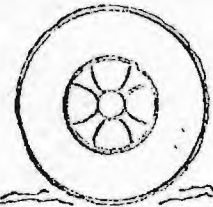
1. Do you think the inspector will accept load test data from one or two trusses if all trusses are not identical?
2. Have you performed the required roof rafter and roof truss load tests as required in Part I, Appendix II of the standards?
3. If the truss you tested passed the loading requirement, will each succeeding truss pass? If you are using plywood braces, you can be sure of this only if all braces from truss to truss are cut to the same size and shape, if the same number of staples are driven into the same locations, if the plywood braces are all of consistent quality, if the same amount of glue is used, etc.

\*\*\*\*\*

WE ARE CONTINUALLY SEARCHING FOR NEW TECHNOLOGY THAT WILL BENEFIT YOUR INDUSTRY. IF YOU KNOW OF A PARTICULAR AREA IN YOUR MANUFACTURING PROCESS THAT NEEDS INVESTIGATION LET US KNOW AND WE WILL BE HAPPY TO CONSIDER IT IN OUR TECHNOLOGY SEARCH.



# TECHNOLOGY FROM TECH



INDUSTRIAL DEVELOPMENT DIVISION  
ENGINEERING EXPERIMENT STATION  
GEORGIA INSTITUTE OF TECHNOLOGY

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HARRY L. STILTZ, PROJECT DIRECTOR

## OUR MESSAGE FOR TODAY

### I N N O V A T I O N    through    A U T O M A T I O N

Have you looked at your roof truss fabrication system lately? What does each truss cost? Have you made a time and motion study lately? Did you include the time required to cut plywood braces, cut wedges, and cut center braces? How good is your quality control? Do the ends of your trusses drop easily into the dadoed runners, or do your employees sometimes have to hammer them in? If they do, have you considered the time required to hammer them in, and sometimes to repair split runners? Do you have room to store a week's supply of purchased trusses?

A recent demonstration showed that (1) a bow string truss can be fabricated by the Gang-Nail system in slightly less than one minute using an inexperienced operator; (2) Using Douglas fir the total cost per truss is \$1.10 or less (3) the truss is ready for immediate use and (4) the truss will exceed the design load specified in the MHMA/TCA Mobilehomes Construction Standards.

This information is furnished as food for thought. Drop us a line if you would like additional information.

### A SPECIAL NOTE FOR TODAY

Some manufacturers are improperly installing the vapor barrier. Are you? It goes on the inside of the insulation to keep moisture inside the home from reaching the insulation and reducing its effectiveness.

APPENDIX I

REVISED LIST OF CONTACT COMPANIES

MOBILE HOMES PROJECT B-343

SEPTEMBER 12, 1968

Southwest Georgia Area Company

Contact & Telephone

1. Cavalier Homes, Inc.  
P.O. Box 160  
Cordele, Georgia 31015  
(912) 273-5320
2. Champion Mobile Homes  
Box 5  
Ellaville, Georgia 31806  
Lester Shewmake  
(912) 937-2811
3. Cullip Industries, Inc.  
P.O. Box 386  
Ellaville, Georgia 31806  
Cecil Cullip  
(912) 937-2421
4. De Rose Industries, Inc.  
P.O. Box 576  
Bainbridge, Georgia  
Bob De Rose or Cecil Hale
5. Marlette Homes, Inc.  
Americus, Georgia  
Tom Holman  
(912) 924-2936
6. Parkwood Homes, Inc.  
P.O. Box 592  
Moultrie, Georgia 31768  
Bob Gaume  
(912) 985-5017
7. Plantation Homes, Inc.  
U. S. Highway 19 North  
Camilla, Georgia  
Jim Allen

Southeast Georgia Area Company

Contact & Telephone

1. Armor Mobile Home Mfg. Co. of Georgia  
P.O. Box 284  
Ashburn, Georgia 31714  
Rex Kennedy or  
Ken Newton  
(912) 567-3373
2. Biltmore Mobile Homes, Inc.  
RFD 3  
Douglas, Georgia  
Al Rose  
(912) 384-3100

- |                                                                              |                                   |
|------------------------------------------------------------------------------|-----------------------------------|
| 3. Douglas Homes, Inc.<br>513 Gaskin Ave.<br>Douglas, Georgia 31533          | W. E. Souther<br>(912) 384-1222   |
| 4. Fleetwood Trailer Co. of Georgia<br>P.O.Box 272<br>Douglas, Georgia       | Morrie Egan<br>(912) 384-1147     |
| 5. Gregory Mobile Homes, Inc.<br>Tift Ave<br>Tifton, Georgia 31792           | Earl Parker<br>(912) 382-7324     |
| 6. Liberty Homes of Georgia, Inc.<br>Box 145<br>Thomasville, Georgia 31792   | Whitey Thompson<br>(912) 226-6122 |
| 7. Skyline Homes, Inc<br>Box 1221<br>Valdosta, Georgia                       | Harry Bearlund                    |
| 8. Valiant Mobile Homes of Ga., Inc.<br>P.O.Box 1195<br>Thomasville, Georgia | Bill Becknell                     |

Atlanta Area

- |                                                                      |                                 |
|----------------------------------------------------------------------|---------------------------------|
| 1. Vintage Homes, Inc.<br>P.O.Box 1962<br>Gainesville, Georgia 30501 | Gerald Newton<br>(404) 532-1266 |
|----------------------------------------------------------------------|---------------------------------|



APPENDIX J

MOBILE HOMES COMPANIES INVITED  
TO FIRST TECHNOLOGY DEMONSTRATION  
AT AMERICUS, GEORGIA, OCTOBER 22, 1968

- |                                   |                          |
|-----------------------------------|--------------------------|
| 1. Champion Mobile Homes          | Ellaville, Georgia       |
| 2. Cullip Industries, Inc.        | Ellaville, Georgia       |
| 3. Marlette Homes, Inc.           | Americus, Georgia        |
| 4. Redman Industries, Inc.        | Americus, Georgia        |
| 5. Biltmore Mobile Homes, Inc.    | Douglas, Georgia         |
| 6. Gregory Mobile Homes, Inc.     | Tifton, Georgia          |
| 7. Liberty Homes of Georgia, Inc. | Thomasville, Georgia     |
| 8. Vintage Homes, Inc.            | Gainesville, Georgia     |
| 9. Walker Mobile Homes, Inc.      | Rockwell, North Carolina |

APPENDIX K

LIST OF ATTENDEES AT GANG-NAIL MOBILE HOME ROOF TRUSS  
DEMONSTRATION at AMERICUS, GEORGIA on OCTOBER 22, 1968

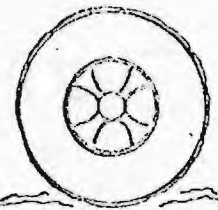
PROJECT B-343

<u>NAME</u>	<u>REPRESENTING</u>	<u>LOCATION</u>
Miles Greer	Georgia Tech, IDD	Douglas, Georgia
O. M. Wellslager	Georgia Tech, IDD	Douglas, Georgia
H. A. Andrews, Jr.	Walker Mobile Homes	Rockwell, N.C.
Oliver Walker	Walker Mobile Homes	Rockwell, N.C.
Ralph L. Darling	Oakwood Trailer Sales	Greensboro, N.C.
Tom Holman	Marlette Homes, Inc.	Americus, Georgia
Art Davis	Marlette Homes, Inc.	Americus, Georgia
Bruce G. Parker	Marlette Homes, Inc.	Americus, Georgia
Eric A. Newsom, Jr.	Georgia Tech, IDD	Albany, Georgia
Frank Moore	West Central Ga. APDC	Ellaville, Georgia
J. P. Luther	Chamber of Commerce	Americus, Georgia
Lester Shewmake	Champion Homes	Ellaville, Georgia
Samuel Lee	Champion Homes	Ellaville, Georgia
Cecil Cullip	Cullip Industries Inc.	Ellaville, Georgia
Bob Watson	Cullip Industries Inc.	Ellaville, Georgia
Harry L. Stiltz	Georgia Tech IDD	Atlanta, Georgia
Bill Studstill	Georgia Tech IDD	Albany, Georgia
L. J. Ballantyne	"Gang-Nails"	Miami, Florida
Ben Sparks	"Gang-Nails"	Miami, Florida





# TECHNOLOGY FROM TECH



INDUSTRIAL DEVELOPMENT DIVISION  
ENGINEERING EXPERIMENT STATION  
GEORGIA INSTITUTE OF TECHNOLOGY

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HARRY L. STILTZ, PROJECT DIRECTOR

## OUR MESSAGE FOR TODAY

### I N N O V A T I O N    through    A U T O M A T I O N

Have you looked at your roof truss fabrication system lately? What does each truss cost? Have you made a time and motion study lately? Did you include the time required to cut plywood braces, cut wedges, and cut center braces? How good is your quality control? Do the ends of your trusses drop easily into the dadoed runners, or do your employees sometimes have to hammer them in? If they do, have you considered the time required to hammer them in, and sometimes to repair split runners? Do you have room to store a week's supply of purchased trusses?

A recent demonstration showed that (1) a bow string truss can be fabricated by the Gang-Nail system in slightly less than one minute using an inexperienced operator. (2) Using Douglas fir the total cost per truss is \$1.10 or less (3) the truss is ready for immediate use and (4) the truss will exceed the design load specified in the MHMA/TCA Mobilehomes Construction Standards.

This information is furnished as food for thought. Drop us a line if you would like additional information.

### A SPECIAL NOTE FOR TODAY

Some manufacturers are improperly installing the vapor barrier. Are you? It goes on the inside of the insulation to keep moisture inside the home from reaching the insulation and reducing its effectiveness.

MEMO ( NOVEMBER 7, 1968 - GUIDELINES

November 7, 1968

MEMORANDUM

To: Eric A. Newsom, Jr. - Southwest Georgia Branch, IDD  
O. M. Wellslager, Jr. - Southeast Georgia Branch, IDD

From: Harry L. Stiltz - Atlanta - IDD

Subject: Project B-343 GUIDELINES

A set of Rules and Regulations for factory manufactured movable homes was promulgated by the Georgia Safety Fire Commissioner in accordance with The Uniform Standards Code for Factory Manufactured Movable Homes Act (Ga. L. 1968, P.415, approved March 26, 1968) and became effective on September 26, 1968. They contain standards for mobile homes body and frame design and construction, plumbing systems, heating systems, and electrical systems.

As soon as I can get additional copies from the State Fire Marshal's Office (I have a meeting there on Tuesday November 12th.) I will send a copy for each field office. However, in the meantime I would like to pass along some important information some of which should be discussed with your contact companies:

1. Has the company performed the required load test on their present roof trusses?

The new standards divide the United States into 3 zones and specify 30 lb/sq.ft. live load for the "North" and "Hurricane" (includes part of South Georgia) zones, and 20 lb/sq.ft. for the "Middle" zone. Since the manufacturer will probably not know what zone the unit will be delivered to, he will undoubtedly design all units for 30 lb/sq.ft. If so, has he performed the required tests (there is also a 12-hour test required with a load of  $1 \frac{3}{4} \times 30$  lb/sq.ft. to see if the truss returns to within L/180 of its original position, where L=length of the truss in inches)?

Now, if the manufacturer tests his present roof truss that is made from glued and stapled plywood, and it passes, how can he be sure that the next one will pass unless all plywood braces are cut to identical sizes as contained in the tested unit, unless the exact number of staples are used and applied in the exact same locations, unless the exact same amount of glue is used, etc.?

Has the manufacturer that purchases trusses tested them? If the supplier is going to have to change his design to "beef up" his trusses, is he going to charge more? As you know, if the supplier is using plywood scraps he will be subject to the same restrictions mentioned above.

Memo to: Eric Newsom & O. M. Wellslager

11/7/68

2. Our next technology transfer (Urethane foam insulation) will be quite important to all manufacturers since a switch to Urethane has so many advantages. Enclosed is a list of these advantages for your review only. Please do not give out any of this information now since it may be changed slightly after my meeting at the State Fire Marshal's Office. For example, they may not agree to waive the requirement for a vapor barrier (although I think they will).

Are you aware that at present most companies improperly install the vapor barriers, or even eliminate them? They can no longer do this under the new Rules and Regulations, and it will be a problem. The vapor barrier must go on the inside of the insulation, but with their present techniques of gluing interior paneling to the studs, they can't put it there. One answer will be to use Urethane foam which acts as its own vapor barrier. Another will be to quit gluing the paneling and use something like the Invis-I-Nail II shown in the enclosed data sheets. Since the vapor barrier is supposed to be unbroken, and since these nails would put holes in it, I need to find out from the State Fire Marshal if they would be acceptable. Hang on to these data sheets until I let you know.

3. I have been advised by the State Fire Marshal's Office that they are giving the manufacturers a few months to use up materials that will not meet the standards and to take whatever other action is necessary to insure that their mobile homes comply with the Rules and Regulations. They plan to send inspectors into all plants within about 60 days.

Any unit that violates the new standards will have a "non-compliance Identification Tag" attached and the unit may only be re-certified by the State Fire Marshal's Office.

4. Now consider a manufacturer like Cullip who may have 25-30 units parked in his lot that do not meet the Effective Flexural Rigidity tests (see my typical calculations and the sheet copied from the standards). It sure would be expensive to re-work all of these units.

If he performs the required tests and his units don't quite meet requirements it is quite possible that switching from Fiberglass to Urethane foam insulation will provide the additional rigidity required.



Memo to: Eric Newsom & O.M. Wellslager

11/7/68

I plan to demonstrate this additional rigidity by putting weights on Joe Tanner's roof before and after foaming and comparing deflection readings. We will prop both ends of the roof on concrete blocks and load the center portion.

5. I still don't know when we will have the demonstration since the chemical engineer from Isocyanate Products, Inc., who is working with me has been out of town lately. I have to coordinate with three companies (one is furnishing the chemicals, one is furnishing technical assistance and the other is furnishing the spray equipment and an operator). However, I will schedule the demonstration at least two weeks in advance as you requested.
6. We will use Isofoam SS24-44 at the demonstration and I have included data on this product. The cost is approximately \$4.00 per gallon, and a typical 12' x 60' unit (with oil or gas heating) would require about 25 gallons. I have also estimated that it would take 2 man-hours to apply the required Urethane foam to this typical unit. From my observations at Vintage Homes, Inc., this is comparable to the time required to install Fiberglass. If you have time, you might make a time study in one plant in each area to see how your figures compare. If they use vapor barriers, this time must be added. If not, we will have to estimate the time required for this operation. Since Vintage does not install vapor barriers, I hope one of you will make your time study in a plant that does.
7. Please note that (after a caution note from Frank and Rudy, and a subsequent re-writing) I do not make a comparison of Urethane foam and Fiberglass. We will only compare it with "other conventional insulating materials".
8. Going back to the Gang-Nail technology transfer, the Bowstring Multihead Press, Model BR 7-6 that we demonstrated sells for slightly under \$2,000.00. The materials required would be 1 - 12' Hemlock 2 x 4 and 21¢ worth of Gang-Nails. The Hemlock 2 x 4 would have to be split, so this time of approximately 10 seconds, added to the 50 seconds for making the truss would then be 1 minute. Please see if you can get an approximate cost of the Hemlock 2 x 4's (in large quantities of say 4,000) from one of the suppliers in your area. With this information, we can tell the manufacturer exactly what it will cost to produce trusses by this method.

Automated Building Components, Inc. designed a truss using the Hemlock 2 x 4's and performed all load tests on it. It exceeds requirements of the new Georgia standards and fails with a total

Memo to: Eric Newsom & O. M. Wellslager

11/7/68

load of 87 lb./sq.ft. They split the 2 x 4 so that the top piece (bowed piece) is  $1 \frac{1}{8}$ " x 2" and the bottom piece is  $2 \frac{3}{8}$ " x 2" (the 2 x 4 is nominally  $1 \frac{3}{4}$ " x  $3 \frac{1}{2}$ " when dressed). As soon as I find out from the company if I can give out this information, I'll include it in a future Technology from Tech note and you can mail it to your contact companies.





## Invis-I-Nail II® installation facts

Invis-I-Nail II is intended for fastening 1/4" wood paneling to a stud wall or other wood construction. Invis-I-Nail II eliminates two steps in panel installation: (1) puttying and (2) touching up nail holes.

Invis-I-Nail's two sides are different. The longer nails are for setting into the material to which the paneling is to be fastened, the lighter and shorter prongs are for receiving the paneling.

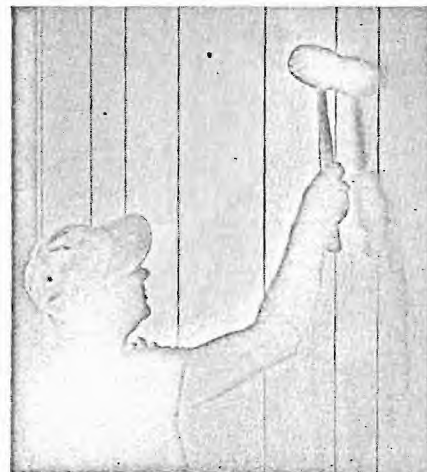
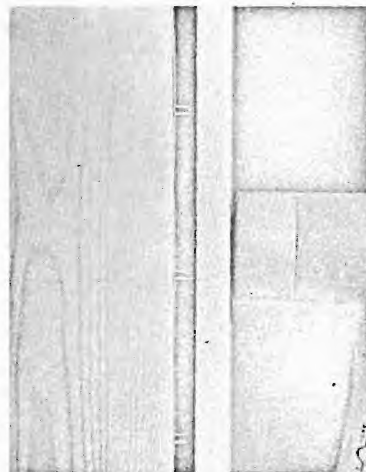
The 3/4" width strip is intended for use at points at which two panels will be butted. The 1/4" width is for single panel edges. Invis-I-Nail's holding power is established as several hundred pounds per panel in tests in which each panel was set with nearly continuous use of the Invis-I-Nail II at all edges and on 16" centers over its width.

A standard claw type hammer can be used to nail the strip to the wall, (hitting as nearly over the nails as possible.) The paneling itself should be tapped with a rubber mallet, thereby seated onto the prongs. The length of the prongs has been determined for use with 1/4" paneling; use of the strip being furnished you with thinner material could result in the tips of the prongs protruding through the face of the paneling, particularly at grooves in the paneling.

The 1/4" strip is packed 100 pieces per carton. The 3/4" strip is packed 50 pieces per carton.

At right- Single and double nail strip. Dots indicate proper target points for hammer.

Below- Installation with claw hammer and rubber mallet.

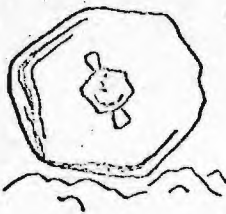


**AUTOMATED BUILDING COMPONENTS, INC.**

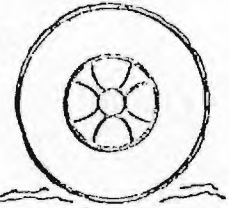
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TELEPHONE (305) 696-0930

SECOND TECHNOLOGY TRANSFER



# TECHNOLOGY FROM TECH



INDUSTRIAL DEVELOPMENT DIVISION  
ENGINEERING EXPERIMENT STATION  
GEORGIA INSTITUTE OF TECHNOLOGY

1132 WEST PEACHTREE STREET, N.W., ATLANTA, GEORGIA 30309

Under a grant from the United States Department of Commerce, Office of State Technical Services, with matching funds from Georgia Tech, staff members of Tech's Industrial Development Division are working on a two-year project to transfer new technology to the mobile homes manufacturing industry.

HARRY L. STILTZ, PROJECT DIRECTOR

## OUR MESSAGE FOR TODAY

YOU ARE CORDIALLY INVITED TO ATTEND

A DEMONSTRATION OF URETHANE FOAM SPRAYED-IN-PLACE

AT

THE SUMTER COUNTY ELECTRIC MEMBERSHIP CORPORATION

AMERICUS, GEORGIA

DECEMBER 5, 1968

FREE LUNCH 12:00 NOON DEMONSTRATION 1:00 P.M.

CONSIDER URETHANE FOAM INSULATION FOR MOBILE HOMES

1. Let's borrow technology from the U. S. Navy:

In 1966 the U. S. Government developed the concept of packaging military equipment with foam chemicals in such a manner that the chemicals would foam in mid-air as the equipment was parachuted from planes.

2. Let's borrow technology from the auto industry:

The U. S. automobile industry uses both flexible and rigid foams in visors, arm rests, seats and other areas. The Volkswagen uses a large block of foam in the firewall and is introducing foam as a poured-in core for hollow aluminum tubular framing to cut vibration, deaden sounds and add rigidity.

Contd.

Consider Urethane Foam Insulation for Mobile Homes

3. Let's borrow technology from the railroad industry:

A passenger train that has been in successful and continuous use in Germany since 1961 uses integral foamed panels for sides, roof and (with structural reinforcement added) floor. The manufacturer has reported excellent performance with increased interior space (due to thinner walls), quieter operation and a weight reduction of over 30%.

4. Let's borrow technology from the construction industry:

Sprayed-in-place foam has been gaining rapidly in residential and industrial insulation. These applications have included pouring of foam around hot and cold water pipes in a 35-story building in Chicago; foamed-in-place insulation for a 21-story building in Buffalo, N. Y., foamed-in-place insulation for a 16-story apartment building in Alexandria, Va., and many other similar applications.

Under section 233 of the National Housing Act, an experimental home in Minneapolis is using Urethane foam, reinforced with plywood and RP (rigid plastic) as a structural insulant, as well as poured-in-place foam for insulation of exterior walls.

As further indication of acceptance of Urethane foam, the FHA has approved Urethane backed siding for home construction, and the State of California has approved Urethane panel relocatable school construction.

Now that we have borrowed the technology of using Urethane foam as insulation, let's see what advantages it has to offer the mobile homes manufacturing industry. The next few pages present some interesting "food for thought".

Contd.



ADVANTAGES OF RIGID URETHANE FOAM INSULATION FOR MOBILE HOMES

1. Urethane foam is produced from liquid components that have a total volume 1/30th of the expanded foam (consider the savings in storage and materials handling).
2. Urethane foam provides from two to four times the insulation value of other insulating materials. (One half inch of Urethane foam will replace one inch or more, of other conventional insulating materials).
3. Urethane foam can be applied to sidewalls, floor and roof by spraying (one man can spray a 1/4 inch layer of Urethane foam over a 1200 square foot area in 30 minutes).
4. Urethane foam is highly resistant to water and water vapor (consider the savings in eliminating vapor barriers).
5. Will support lower cost aluminum wiring and eliminate many present problems of aluminum wire breakage during transit. (If sprayed after wiring installation.)
6. Urethane foam has a compressive strength of 20 to 60 pounds per square foot (consider the additional rigidity obtainable for sidewalls and roof. Also consider the "Effective Flexural Rigidity" requirements contained in the new Georgia Rules and Regulations for Factory Manufactured Movable Homes. If you don't meet the minimum  $\overline{EI}$  requirement it's possible you can avert a re-design merely by using Urethane Foam insulation.) A sample calculation is shown below:

(a) Typical Calculation of Mobile Home Effective Flexural Rigidity

$$\overline{EI}_f = 36(L_f)^3 (P/y)_f \text{ lb-in}^2 \quad \begin{array}{l} \text{(see Part I paragraph 6.11} \\ \text{Georgia Rules \& Regulations} \\ \text{Factory Manufactured Movable Homes)} \end{array}$$

(1) Assumptions for a 12'x60' mobile home

1.  $L_f = 40'$
2. Test Load  $P = 500 \text{ lb}$
3. Deflection  $y = 0.3''$

$$\begin{aligned} \text{Solve for } \overline{EI}_f: \\ \overline{EI}_f &= (36) (40)^3 \left( \frac{500}{0.3''} \right) \\ &= (1.2) (64) (5) \times 10^7 \\ &= 38.4 \times 10^8 \quad \text{(Not Acceptable)} \end{aligned} \quad \begin{array}{l} \text{(see Figure 1 Appendix} \\ \text{1, Georgia Rules and} \\ \text{Regulations)} \end{array}$$

(2) Change assumption for (y) to 0.1":

$$\begin{aligned} \overline{EI}_f &= (3) (38.4) 10^8 \\ &= 115.2 \times 10^8 \quad \text{(Acceptable)} \end{aligned}$$

In this case, the maximum allowable deflection would be approximately 0.1". If the deflection is greater than 0.1", it is possible that using Urethane Foam insulation will provide sufficient structural strength to reduce the deflection to 0.1" or less.

Contd.

7. Urethane foam fills all voids and adheres readily to any clean surface (See Heat Loss Certificate requirement - Part I, Paragraph 7.5, and Airtightness of Supply Duct Systems - Part III, Paragraph 6.10.4, Georgia Rules and Regulations)

8. The new Georgia Rules and Regulations require the following minimum resistance (R) factors:

<u>Type of Fuel</u>	<u>Wall</u>	<u>Ceiling</u>	<u>Floor</u>
Gas or Oil	5.5	8.2	5.5
Electric	6.5	13.0	12.0

The total R value is obtained by adding the insulation R value to the R value of mobile home construction. Typical Construction R values, excluding framing, have been calculated to be:

Sidewalls R=2.0, Floor R=3.0, Ceiling R=3.0

However the Rules and Regulations state that the actual Construction R values must be calculated.

a. To determine the required insulation R factors, let's assume the calculated Construction R value equals the typical Construction R value. The minimum required insulation R factors would then be:

<u>Type of Fuel</u>	<u>Wall</u>	<u>Ceiling</u>	<u>Floor</u>
Gas or Oil	5.5-2.0=3.5	8.2-3.0=5.2	5.5-3.0=2.5
Electric	6.5-2.0=4.5	13.0-3.0=10.0	12.0-3.0=9.0

b. Since one inch of Urethane foam has an R factor of 9.0, the following foam thicknesses would be required:

<u>Type of Fuel</u>	<u>Urethane Foam Thickness (Inches)</u>		
	<u>Wall</u>	<u>Ceiling</u>	<u>Floor</u>
Gas or Oil	0.39	0.58	0.28
Electric	0.50	1.11	1.00

9. The Urethane chemicals require less than 5% of the storage space required by conventional insulations.

a. Assuming that a mobile home manufacturing plant produces eight 12'x60' (gas or oil heated) units per day and that a 10-day supply of Urethane is stocked, storage space requirement would be as follows:

Urethane foam volume per unit:

$$\begin{aligned} \text{Walls} &= 10 \times 144 \times \frac{.39}{12} = 47 \text{ cu. ft.} \\ \text{Ceiling} &= 12 \times 60 \times \frac{.58}{12} = 35 \text{ cu. ft.} \\ \text{Floor} &= 12 \times 60 \times \frac{.28}{12} = 17 \text{ cu. ft.} \end{aligned}$$

$$\text{Total foam req'd} = 99 \text{ cu. ft.}$$

Contd.



Since the Urethane foam is 30 times greater in volume than the chemicals, storage space required would be:

$$\frac{99}{30} = 3.3 \text{ cu. ft. (25 gallons) per unit.}$$

For a 10-day supply the storage space required is:

$$3.3 \text{ cu. ft.} \times 8 \text{ units/day} \times 10 \text{ days} = 246 \text{ cu. ft. (2000 gallons)}$$

# urethane in building

SECTION

U/B 1-1

## RIGID URETHANE FOAM'S HIGH INSULATING EFFICIENCY YIELDS SAVINGS IN HEATING AND AIR-CONDITIONING COSTS FOR ALL TYPES OF BUILDINGS

Rigid urethane foam has been called "super-insulation" because, inch for inch, it provides two to four times the insulation value of other insulating materials. (See chart at right.)

Highly resistant to water and water vapor, it retains its insulation effectiveness indefinitely.

Because it is more efficient, urethane foam can maintain insulating values at about half to one-third the thickness of other insulating materials. Among the advantages this provides are shipping and handling savings and thin-wall construction, leading to more usable interior space.

When applied as a liquid chemical system, urethane foam adheres tightly to virtually all building materials, filling and sealing the space it occupies. Thus, no heat leaks are permitted.

Rigid urethane is lightweight, yet it has remarkable strength for its weight.

Urethane foams with self-extinguishing and flame-retardant ratings are readily available.

## URETHANE SEALS WALLS, ROOFS, FLOORS, STOPS HEAT/ COLD LOSSES EVERYWHERE

Rigid urethane foam's excellent insulating ability, unique strength and availability as a slab material or as a liquid system which can be installed by several methods are key reasons for its selection for these insulation assignments:

**Masonry Walls:** Using rigid urethane foam, a builder can insulate and install a plaster base in a single, cost-cutting operation that can eliminate the need for furring and lathing.

**Cavity Walls:** A high insulating ability and availability as a liquid system make urethane foam a natural for cavity wall insulation. Shredded fibrous materials, for example, dumped into cavity wall spaces may hang up on in-wall obstructions such as masonry wall ties, causing insulation voids. Up to 9-ft. high cavity walls can be filled with urethane foam at one time to form void-free insulation that seals the interior, increases the wall's strength. Boardstock also works well here.

**Roof Insulation:** Roofs are subjected to more weather factors which affect inside environmental conditions than any other exterior surface. In addition to its value as insulation and as a moisture vapor barrier, urethane foam also helps maintain the structural integrity of the roof system. Urethane's light weight can reduce the dead load of a roof by up to 75%, leads to savings in

COMPARATIVE INSULATING EFFICIENCY			
Material	k* factor	R for 1-in. thickness	Thickness for Equivalent Insulating Value
Urethane	0.11	9.0	1"
Glass Fiber	0.22	3.8	2"
Wood Fiber	0.27	3.7	1.9"
Styrene Foam	0.28	4.2	2.8"
Mineral Wool	0.3	3.3	1.9"
Foam Glass	0.38	2.5	3.8"
Vermiculite	0.48	2.08	3.4"

\*The lower its k factor and the higher its R, the more effective is an insulating material.

Rigid urethane foam can provide savings in building costs as well as in operating costs.

It is the only building insulation material that can be obtained as boardstock, as a structural core in building panels or as a liquid chemical system which can be installed on site by the pour, froth or spray techniques. The designation "rigid urethane foam" covers all types.

installation time and labor. It has good compressive strength to resist heavy snow loads.

**Urethane** has been applied to roofs by installing boardstock and by pouring-in-place. Each type is coated or covered with built-up roofing. Urethane, faced with roofing felt, is used like fibrous board roof insulation. Sprayed urethane is solving the problem of insulating unusual shapes, including corrugated, arched and elliptical roofs.

**Perimeter Insulation:** Rigid urethane foam sharply reduces heat transfer along a building's concrete foundation. Here, urethane's chemical inertness and moisture resistance are most important.

**Residential Insulation:** Urethane foam can be spray-applied to insulate basements, walls and attics. Besides providing excellent insulating ability, it seeks out and seals difficult-to-insulate areas such as above windows and in narrow spaces around windows and doors. Urethane boardstock offers the same high insulating effectiveness and is also widely used in residential construction.

**Other Uses:** Urethane foam is also used to insulate crawl spaces, cathedral ceilings, pipes and other building elements. This can be done on site with a liquid system or with preformed materials such as pipe insulation jackets which are delivered from the manufacturer ready for installation.

Contd.

## FOAM REACTION IMPARTS HIGH INSULATING ABILITY

Rigid urethane foam is a cellular plastic that is formed by the reaction of two liquid chemicals (isocyanates and polyols) in the presence of certain additives and catalytic agents.

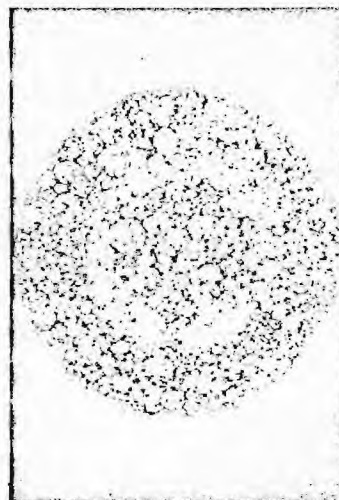
The mixture begins to foam instantly and quickly expands to about 30 times its original volume. The self-hardening foam completely fills the area, space or cavity to be insulated.

The chemical reaction which creates the foam takes place in the factory in the case of urethane boardstock or on location in the case of foamed-in-place urethane.

Wherever it is made, the foam contains many tiny cells, each filled with a minute quantity of gas produced by the foaming process. The gas, trapped in the cells and occupying more than 95% of the foam's total volume, plays a key role in giving rigid urethane its insulating properties. The gas has extremely low heat conductance, bars most conductive vapors and keeps to a minimum internal convection.

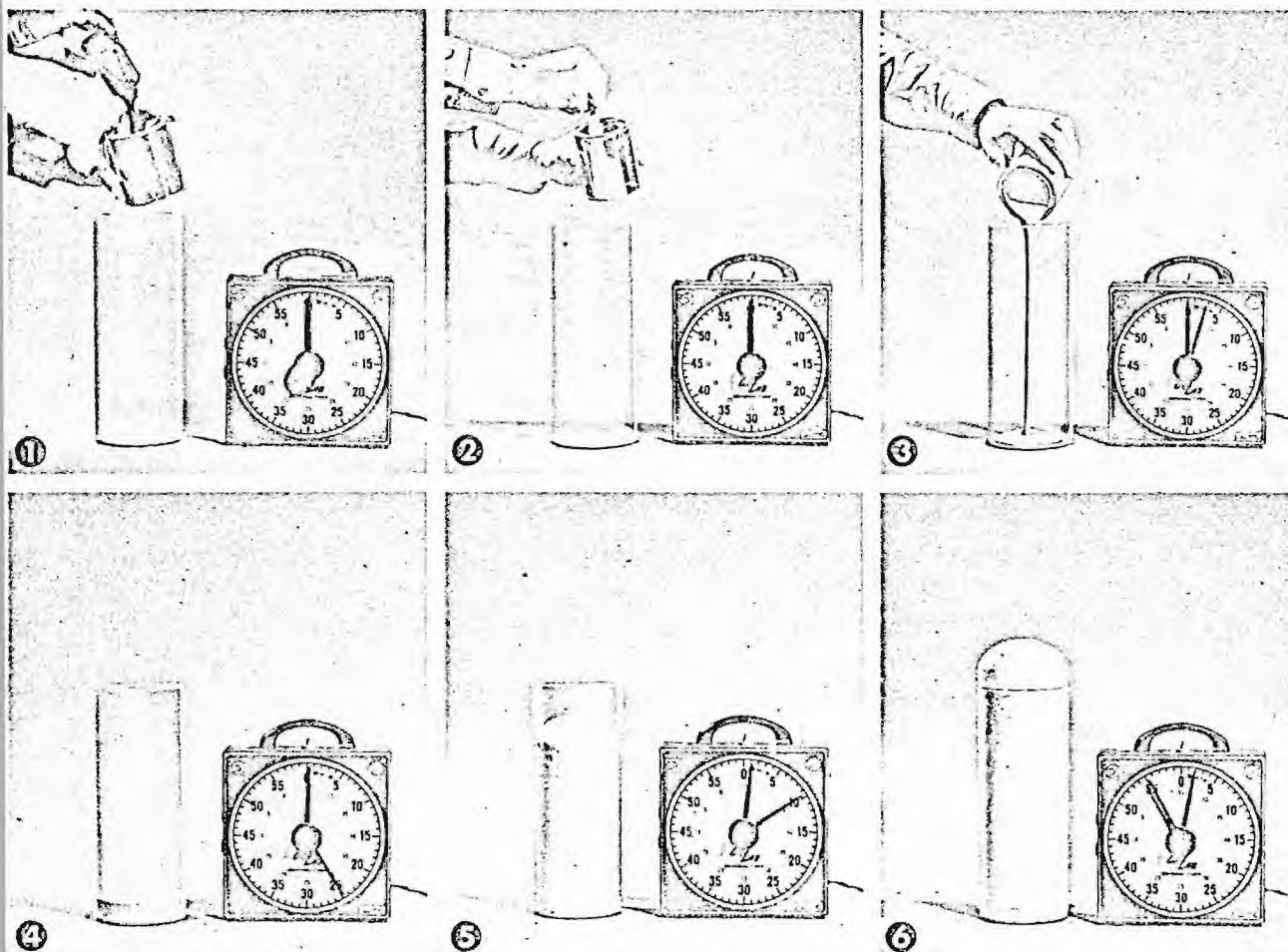
Rigid urethane foam is not a single material,

Photomicrograph shows the network of closed cells which gives rigid urethane foam its unusual strength and superior insulating value. There are about 1,000,000 cells in one-inch urethane cube.



but rather a class of materials with different formulations and different densities for different applications. Urethane foams in widest commercial use have densities—ratio of gas to plastic—of 1.5 to 3.0 pounds per cubic foot.

## LABORATORY DEMONSTRATION OF BASIC FOAM PRODUCTION PROCESS



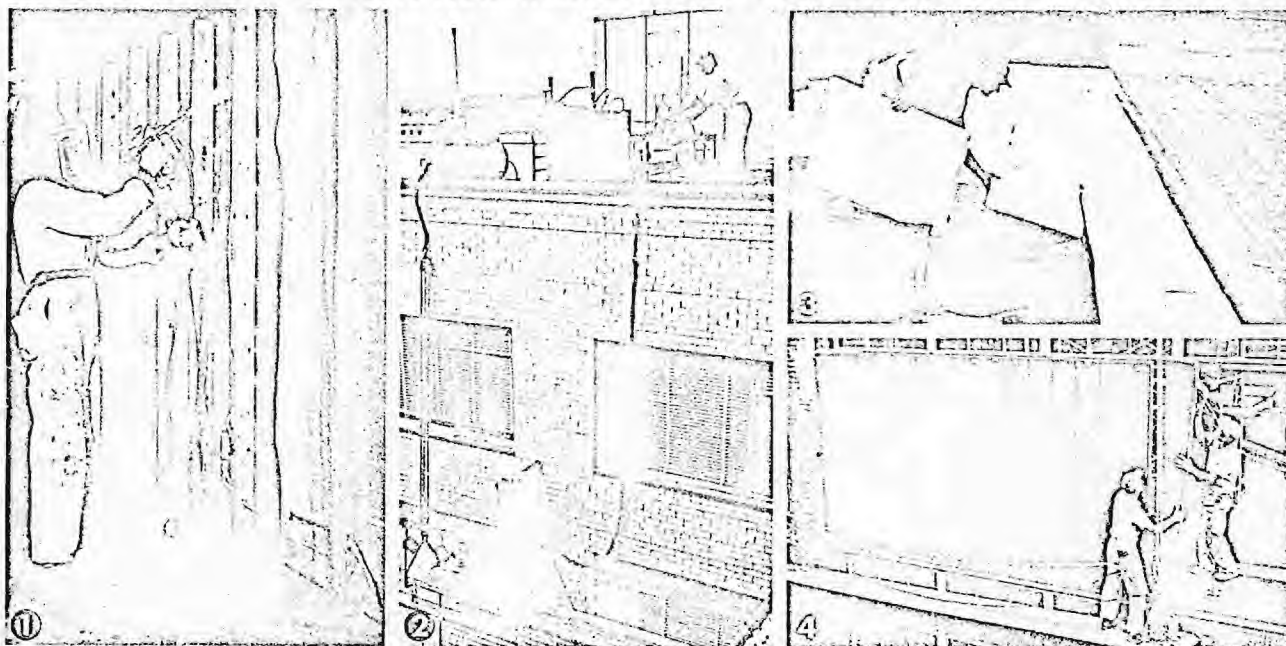
These photographs illustrate the basic foaming process. (1) The two liquid chemical components are combined, (2) agitated for thorough blending, (3) poured into a receptacle where the foaming reaction begins immediately,

and (4, 5) expansion continues until (6) the rise is completed. Foam is tack-free shortly after completion of the rise. The rigid foam is 30 times the volume of the original chemicals leading to savings in shipping, handling costs.

Contd.



## RIGID URETHANE FOAM PROVIDES WIDE CHOICE OF INSTALLATION METHODS TO SATISFY INSULATION REQUIREMENTS IN OLD AND NEW CONSTRUCTION



Urethane foam can be applied by a method best-suited to the individual job requirements: (1) Spray technique seals area between wall studs in new construction, (2) A foam-in-place method is used to insulate closed wall cavity in

major renovation project, (3) Slab boardstock is used to insulate roof and (4) Panels with core of lightweight rigid urethane foam which provides rigidity and insulation are fast way to enclose buildings.

Rigid urethane insulation can be foamed-in-place at the building site wherever insulation is required. Or it can be factory-produced and delivered to the job site for installation as slab boardstock, insulated building panels, doors, siding and other products.

### FOAM-IN-PLACE

Urethane foam can be produced at the building site by pouring, spraying or frothing the liquid components. These foam-in-place techniques are useful in insulating walls, roofs and other elements in new construction or hard-to-reach areas in existing buildings. Because urethane foam is produced from liquid components occupying 1/30 the volume of the expanded material, substantial savings in shipping, inventory and material handling costs are realized.

**Pouring:** This is an excellent method for installing a strong, seamless core of rigid urethane in wall cavities and on roofs. The foam fills all angles and corners of any space or cavity, going under pipes and wiring, around corners and into crevices.

**Frothing:** In this technique, the urethane chemicals are dispensed in a partially expanded state. Because the froth expands only about three times in the cavity rather than 30 times, this process often reduces pressure on mold or cavity walls.

**Spraying:** Large open surfaces such as walls or roofs can be covered with sprayed-on layers of rigid urethane, using special gun-type apparatus. The chemical components are mixed and atomized as they are sprayed. To attain the desired thick-

ness, thin layers are sprayed on successively, each adhering to the surface below, hardening, curing and sealing rapidly. The urethane foam surface may remain exposed, but normally it is covered.

### MANUFACTURED URETHANE INSULATION

**Boardstock or slabstock:** This rigid urethane foam is produced at a factory where it is cut into flat sheets of different thicknesses (generally 3/4" to 6") and standard sizes. For many uses it is delivered and installed uncoated. For others, protective coatings, mastics, paints or structural or decorative skins may be applied in the manufacturing process.

Boardstock is used to insulate masonry, cavity walls, perimeters, slabs, foundations, basements and roofs. It is often applied with mastics or other adhesives, in some cases with nails or similar fasteners. No special equipment is needed.

**Building panels:** Lightweight sandwich panels that are strong and rigid are produced by injecting urethane chemicals between skins of aluminum, steel, glass fiber, plastic or plywood where the foaming reaction occurs. Urethane foam adheres readily; therefore, no adhesives, sealants or connecting devices are required.

Rigid urethane foam's good structural strength makes possible the use of lighter gauge skins with no loss in strength. The light weight of rigid urethane foam also helps to make it an ideal core material for stressed sandwich panels, curtain walls and other structural members. The lightweight panels can be installed quickly.

Contd.

## MOISTURE RESISTANCE, LONG LIFE, STRUCTURAL RIGIDITY ARE PART OF URETHANE INSULATION PACKAGE

In addition to its unequalled thermal resistance, rigid urethane foam boasts many other properties essential in building construction.

**Minimum Water Absorption:** The stable, strong, cellular structure of rigid urethane foam locks out water penetration, the traditional bugaboo of building insulation.

**Fire Retardance:** Self-extinguishing urethane foams are readily available. Urethane foams with various degrees of fire retardancy to meet code and insurance specifications for many types of buildings are also available.

**Long Life:** Urethane foam is inherently tough, does not crumble, pack down or absorb moisture. It is these properties—so important for building insulation—that have made urethane the preferred insulation material in the refrigeration and transportation industries.

Many urethane foam installations have been in service for more than 12 years with no disintegration or other failure. Accelerated laboratory tests confirm that carefree service will continue.

**High Dimensional Stability:** Even under a wide range of temperatures (225°F to -300°F) and humidity, rigid urethane foam does not shrink or expand to form voids or dead spots which would reduce insulating efficiency.

**Low Water Vapor Permeability:** Rigid urethane foam has a moisture-passing rating in the range of one to four perm-inches, depending on density and formulation. This is frequently a sufficient moisture vapor barrier.

**Self-Adhering:** Foamed-in-place urethane adheres permanently and securely to virtually all building surfaces as it foams. Standard adhesives can be used to hold urethane boardstock material firmly in position.

**Structural Strength:** Rigid urethane foam has outstanding strength for its weight, increasing the strength of walls and other structural sections by as much as 100%. In a 1.5 to 2 pounds per cubic foot density, urethane has a compressive strength of 20-60 pounds per square foot. Its flexural and shear strength properties are excellent, making it possible to use thinner and lighter metal skins in urethane-core building panels with no loss in strength.

COMPARATIVE STRENGTH OF INSULATION MATERIALS				
Insulation	Density (lb./cu. ft.)	Strength (lb./sq. in.)		
		Com- pressive	Flexural	Shear
Rigid Urethane Foam	2	35	45	25
Polystyrene Foam	2	35	45	30
Cork	6	10	26	—
Glass Fiber Board	6	3	80	—
Western Pine	25	5,000	9,000	1,100

## MORE EFFICIENT BUILDING METHODS AID ARCHITECTS, ENGINEERS, OWNERS

In computing the cost of urethane foam, the following factors should be considered:

1. In certain types of construction, rigid urethane foam can eliminate furring, lathing and vapor barriers.

2. Urethane's light weight can reduce load-bearing structural requirements in a building with corresponding cost savings.

3. Because it is more efficient than other insulating materials, urethane foam can be used in thinner sections reducing shipping, storage and handling costs. And when shipped to the job site as a liquid, urethane occupies only 1/30 the space of block-type materials to significantly reduce the per-foot cost of urethane foam insulation.

4. Thinner exterior walls make possible more useable and/or more rentable space.

5. The better insulation provided by rigid urethane foam lowers heating and cooling costs.

## CASE HISTORY REPORTS SHOW HOW TO REDUCE HIGH BUILDING COSTS

1. Sprayed urethane wall insulation in apartment building in Virginia eliminated furring and rock lath, cut installation costs by 35%. (Heating, cooling costs expected to be 10% lower per year, too.)

2. Urethane boardstock in New York State school cut dead load of roof by 300,000 pounds to reduce structural requirements as well as shipping, material handling, labor costs.

3. By eliminating furring, other steps, urethane foam insulation for exterior block walls and precast concrete ceiling saved Pennsylvania builder up to \$100/1000 square feet of wall area..

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**MOBAY CHEMICAL COMPANY**

o

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Chicago, Ill. 60645

6055 E. Washington Blvd.  
Los Angeles, Calif. 90022

Contd.





## ISOFOAM® SS 24-44

Self Extinguishing Urethane Foam for Spray Application

### GENERAL

ISOFOAM SS 24-44 is a urethane chemical foam system specially formulated for application by airless spray. It combines excellent insulating properties with its ability to not support combustion. The low density foam produced has excellent load bearing characteristics.

ISOFOAM SS 24-44 is a two-component system and is sprayed in a 1:1 ratio. Application by spray is easy, fast (1200 sq. ft. of 1/4" insulation in 30 minutes per operator is normal), and efficient.

### APPLICATIONS

Insulating the outside of tanks.

Insulating process equipment.

Insulating walls, ceilings, and floors of:

- buildings
- cold storage rooms
- freezing rooms
- railroad cars
- trucks and trailers
- mobile homes

Controlling condensation on metal surfaces in humid conditions.

### ADVANTAGES

Self-extinguishing—will not support combustion

Superior insulating power—thinner walls needed

Forms excellent bond with clean surfaces

Forms a rigid monolithic insulating panel—doesn't settle

Easily and quickly applied—saves time and labor

Has good chemical resistance

Has outstanding load bearing property

Has excellent dimensional stability



## TYPICAL PHYSICAL PROPERTIES

### SS 24-44

Part A, Viscosity @ 70°F. 400 cps

Part B, Viscosity @ 70°F. 250 cps

### FOAM

The following physical properties were obtained on samples produced by commercially available airless spray equipment.

### MECHANICAL

Nominal Density, lb. per cu. ft.	2
Compressive yield strength (ASTM C-165-54)	
Parallel to foam rise, psi	34.3
Perpendicular to foam rise, psi	13.8
Closed cell content	>90%
Aged "K" factor	
BTU/hr./sq.ft./°F./in.	0.15
Water Absorption (MIL-P-21929A), lb./sq.ft.	0.07

### AGING CHARACTERISTICS

200°F. for 3 days, % volume change	+8.0
-20°F. for 3 days, % volume change	<1
140°F. at 90% humidity for 7 days	
% volume change	+7.3

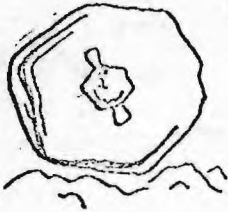
### FLAMMABILITY

ASTM 1692-67T	S.E.
	<1 inch <60 sec.

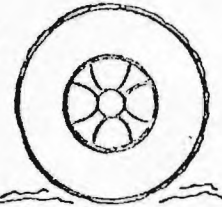
LIST OF ATTENDEES

URETHANE FOAM INSULATION DEMONSTRATION  
MOBILE HOME TECHNOLOGY TRANSFER PROJECT

<u>NAME</u>	<u>COMPANY</u>	<u>ADDRESS</u>	<u>TITLE</u>
Harry Stiltz	Georgia Tech	Atlanta	Project Director
Bill Studstill	Georgia Tech	Albany	Engineer
W. Miles Greer	Georgia Tech	Douglas	Asst. Research Scientist
Eric A. Newsom	Georgia Tech	Albany	Director
O. M. Wellslager	Georgia Tech	Douglas	Director
John Frazer	Georgia Tech	Macon	Res. Scientist
Tom Holman	Marlette	Americus	Plant Mgr.
Bruce Parker	Marlette	Americus	Asst. Plant Supt.
Jerry Bell	Marlette	Americus	P. A.
Richard F. (Dick) Blomquist	Forestry Sci. Lab.	Athens	Proj. Leader Housing Research
Harold F. Zornig	Forestry Sci. Lab.	Athens	Research Engineer
Phil Lawrence	Redman	Americus	I.E. Mgr.
Terrill Bridges	Redman	Americus	Prod. Mgr.
Bob Watson	Cullip	Ellaville	Supt.
Andy Vanlerbergh	Cullip	Ellaville.	
Bob Jones	Cullip	Ellaville	Sales Mgr.
Walt Sheneman	Isocyanate Prod. Inc.	Atlanta	S. E. Sales
Bob DuBois	Bright Leaf Corp.	Douglas	Vice President
Bob Moser	Binks Mfg. Co.	Atlanta	Sales
D. G. Sabin	Georgia Power Co.	Atlanta	Mgr. Res. Sales
L. J. Usher	Usher Const. Co.	Savannah	Pres.
Ron Lorence	Foremost Ins. Co.	Atlanta	Damage Research Reg. Coordinator
H. R. Haley	Ins. Co. of N. America	Atlanta	Sr. Repr.
Frank Moore	West Central Ga. APDC	Ellaville	Executive Director
Norris Day	Conner Ind.	Macon	Gen. Mgr.
J. P. Luther	Chamber of Commerce	Americus	



# TECHNOLOGY FROM TECH



INDUSTRIAL DEVELOPMENT DIVISION  
ENGINEERING EXPERIMENT STATION  
GEORGIA INSTITUTE OF TECHNOLOGY

1132 WEST PEACHTREE STREET, N.W., ATLANTA, GEORGIA 30309

Under a grant from the United States Department of Commerce, Office of State Technical Services, with matching funds from Georgia Tech, staff members of Tech's Industrial Development Division are working on a two-year project to transfer new technology to the mobile homes manufacturing industry.

HARRY L. STILTZ, PROJECT DIRECTOR

## OUR MESSAGE FOR TODAY

### CONSIDER URETHANE FOAM INSULATION FOR MOBILE HOMES

Did you know that Urethane foam is an excellent insulating material? Have you considered using it in your mobile homes? Did you know you can spray it on the walls, floor and ceiling between the framing and that it expands to thirty times it's original volume while being sprayed? If you would like additional information drop us a line.

### TECHNOLOGY IS WHERE YOU FIND IT

#### 1. Let's borrow technology from the U. S. Navy:

In 1966 the U. S. Government developed the concept of packaging military equipment with foam chemicals in such a manner that the chemicals would foam in mid-air as the equipment was parachuted from planes.

#### 2. Let's borrow technology from the auto industry:

The U. S. automobile industry uses both flexible and rigid foams in visors, arm rests, seats and other areas. The Volkswagen uses a large block of foam in the firewall and is introducing foam as a poured-in core for hollow aluminum tubular framing to cut vibration, deaden sounds and add rigidity.

SEMHI RESEARCH COMMITTEE

# SEMHI Research Committee Meeting Notice

A copy of the notes from the meeting of November 7th is attached. Mr. Andrew Steiner has asked that a maximum of two representatives of each of the following colleges meet with him again at the SEMHI office at 348 East Paces Ferry Road, N.E., on November 21st at 10:00 A.M., for further discussion of the role of the colleges in research and development which would be beneficial to the goals of SEMHI. He suggests the following members as being representative of the various expertises involved:

For University of Georgia	Dr. Melvin, ICAD
	Mr. Tate, School of Business
For Georgia State College	Dean Lacey (or Mr. Forbes
	Dr. Knight
For Georgia Tech	Dr. Kelnhofner, City Planning
	Mr. Frank Clarke, IDD

It is understood that Dean Lester of Emory University wishes to be kept informed of the proceedings of the committee but is unable to send representation to it.

Dean Barksdale of Atlanta University has been invited to send representation too.

If possible, each representative should bring with him any information as to the extent, kind and scope of work now planned or in progress at his college which may be relevant to the goals of the SEMHI.



SEMHI Research Coordination Committee

Meeting held November 7, 1968 at Industrial Development Division, Georgia Tech

Mr. Andrew Steiner held his second meeting with representatives of area colleges in an effort to determine the extent of present or planned research which might be utilized in the R & D program which he is coordinating for the Southeastern Mobile Housing Institute. At the first meeting held at the Executive Park Motel only University of Georgia and Georgia Tech were represented. This meeting was intended to obtain information from other area colleges as well. Emory University expressed an interest in participating in the program but was unable to send a representative to the meeting. Atlanta University Center was invited to send a representative but did not respond.

Present at the meeting were:

Mr. Andrew Steiner, SEMHI  
Mr. John Manley, SEMHI  
Dr. Willis Knight, Georgia State  
Dr. Ernest Melvin, University of Georgia  
Mr. Wray Buchanan, University of Georgia  
Mr. Rudy Yobs, Georgia Tech  
Mr. Harry Stiltz, Georgia Tech  
Prof. Guy Kelnhofner, Georgia Tech  
Mr. Frank Clarké, Georgia Tech (acted as moderator)

Mr. Richard Forbes, Georgia State was expected but due to a confusion on the date of meeting was absent.

At the request of Mr. Steiner, Mr. Clarke opened the discussion by recapping the interest which Georgia Tech has in the mobile homes industry thru its Special Merit project with STS. He also mentioned that Tech has worked with Urban America in determining the housing requirements of Dalton, with other cities thru the Certified Cities program (which Mr. Yobs explained in detail), with the Model Cities program thru the EDA and with the Southern Center for Studies in Public Policy. In connection with this discussion of Tech's involvement, Mr. Steiner commented that there was a need for short, pithy questionnaires which would cover salient points rather than exhaustive ones similar to those now used in Certified Cities program. Mr. Yobs pointed out that an exhaustive questionnaire had the advantage of providing in a single document the entire picture which a community must consider in its plans. Dr. Melvin concurred.

Mr. Buchanan was asked to outline the activities of University of Georgia of possible interest to the Housing industry. He opened by asking whether SEMHI or the mobile home industry was attempting to change the image of the industry. Mr. Manley replied that the FHA was pressing for more conventional appearing units. He distributed a flyer showing one typical unit. This unit, commented Dr. Melvin, is notable because it provides space for the head of household, something which many psychologists consider highly desirable.

Contd.

November 13, 1968

Mr. Manley continued and said that a set of standards better suited to the market for mobile home parks in the South is being published by the FHA. This new standard which covers one of three levels of development of the park concept, will provide the means of reducing the cost per space created in a mobile home park. SEMHI will then work for uniform regulations in each state in its area.

Mr. Buchanan asked about the recreational aspects of mobile home and travel trailers, saying that University of Georgia had a major interest in this field as a part of its recreational development program. Mr. Manley replied that his group prefers to keep the two segments of their industry separated, i.e., the portion devoted to those who make their home in a mobile home and those who use a unit occasionally for leisure. These are two quite different groups with different motivations. Dr. Melvin asked about the acceptance of mobile homes by local communities, particularly the problem of taxes and demand for local services. Mr. Manley stated that due to Georgia Tech's study of the taxes paid by mobile home owners it had been shown that mobile home owners make less demand on public services than expected, principally because so many occupants do not have school age children. There is still local resistance to the idea of bringing housing into the community without providing jobs for local workmen or for local furniture stores, etc. but Georgia now has 50 mobile home plants, so many units must be being sold.

However, it is unlikely that FHA will ever permit regular mobile homes to be substituted for the units which are conceived under their six programs for various age groups, and at various price levels, from \$8,000 to \$25,000 per unit. A source of these units is essential.

Mr. Steiner stated that efforts must be made to develop in each market a innovative manufacturer in each Southeastern state who will be receptive to new ideas. Dr. Melvin asked whether anyone knew what the potential buyers of mobile homes wanted in their units. Mr. Manley said that General Electric had made a complete study on this subject. Mr. Steiner showed a proposal being circulated by Stanford Research Institute which outlines a study of the contribution of the mobile homes industry that would be studied by the institute. Contributions from mobile home interests would fund the work. Mr. Clarke pointed out that similar proposals could be readily generated but that the industry showed only limited interest in new concepts in housing. Mr. Manley agreed saying that most of the industry was at full production on a profitable basis. Mr. Steiner emphasized that this meant that newcomers would have to be found to carry out the necessary research and development of the housing which he advocates. Mr. Yobs asked if this gap wasn't being filled by the very large national companies. Both Mr. Manley and Mr. Steiner agreed and felt that this trend would accelerate if the Vietnam war stopped. Mr. Steiner felt that an industry of monolithic type like automobile manufacturing might result. Mr. Manley felt that the key to success was the ability to produce housing, but one limitation already present was the lack of trained personnel to staff and man the factories. The only hope seems a move towards automation of as many operations as possible. Mr. Stiltz commented that this would be one aspect of his study. Mr. Kelnhofer said that there is a need for self help housing where the cost of the unit would be offset in part by the work done by the owner or his friends. The need was for housing at a very low cost, particularly

Contd.

SEMHI Research Coordination Committee

November 13, 1968

in the rural areas. Mr. Buchanan then mentioned that a Rural Development Center was being established at Tifton but its functions were undetermined at this time. It might be a good place to determine the needs for housing which could be met by a series of actions including work planned at the Housing Resources Center at Georgia Tech. Mr. Steiner said that he felt that the housing center should be a part of the Urban Life Center at Georgia State rather than at Tech. Mr. Clarke non-concurred pointing out that a regional housing resources center was planned with far broader interests than those of Georgia cities alone. Dr. Knight stated that the Chancellor's committee on the functions of Georgia State had found that the urban life center was to play a major role in the functions of the college. Mr. Steiner said that the matter would require further study and did not require resolution now.

Mr. Manley asked for the opinion of the group on a State Housing Authority. If the group concurred, should the University System offer its assistance to an authority, or what should its role be.

Mr. Clarke said that Dr. Whitlatch of Tech had discussed the idea of a State Housing Authority as a vehicle for funding but he knew of no other action. None of the others present knew what the University System's view would be.

Mr. Steiner said that no matter what form future plans took, it was essential that as many of the universities as possible participate in the SEMHI planning. He also recommended the inclusion of Dr. Slamecka and other information scientists and computer specialists. In toto, there should be action programs proposed for each college. But, first, it is essential that the range and scope of research now planned or in progress be determined, not only for Georgia but on a national scale. Mr. Manley agreed that a written statement of the intentions of the group was essential, pointing out that the DOD itself was seeking ways of studying low cost housing effectively. Couldn't this be done in Georgia if a workable program for university study already existed.

Mr. Clarke stated that his group on Tech campus would be determining the various interests in housing matters among its faculty. He recommended that each of the other college representatives try to make a similar determination. He pointed out that there weren't any funds for this inventory, but an attempt might still be made despite this shortcoming since housing was a major problem throughout the state. He commented briefly on the work of Mr. Kelnhofer and other City Planning faculty members and their students with the Bedford-Pine redevelopment project and his own involvement with Mr. Chanin and the Southern Center at Clark College. He stated that Tech felt that housing represented one vehicle for student participation in social action on a constructive basis.

It was agreed that further meetings would be held as information on the status of research and development relevant to housing was obtained.



TRIP REPORT

AUTOMATED BUILDING COMPONENTS, INC.

TRIP REPORT

Project B-343

AUTOMATED BUILDING COMPONENTS, INC.

Miami, Florida

By: Harry L. Stiltz

November 4, 1968

At the invitation of Automated Building Components, Inc., I visited their plant in Miami on November 1, 1968, to determine if there would be additional technology applicable to the mobile homes industry from this source. I also wanted to obtain information on mobile home roof loading tests that are being performed by this company.

The Georgia Safety Fire Commissioner put into effect on September 26, 1968, a set of Rules and Regulations in accordance with The Uniform Standards Code for Factory Manufactured Movable Homes Act (Ga. L. 1968, P-415, approved March 26, 1968). These Rules and Regulations provide standards for construction, heating systems, electrical systems and plumbing systems that must be adhered to by all mobile home manufacturers in Georgia.

It is the opinion of the Project Director that many mobile homes being produced in Georgia do not meet these standards even though they have been in effect since September 26, 1968. As an example, the standards require an insulation vapor barrier in walls, floor, and ceiling whereas some manufacturers eliminate this item completely, while others install it improperly. The vapor barrier is to be installed between the insulation and the inside of the home to prevent inside moisture from penetrating the insulation and reducing its insulating capability. However, under present construction techniques it is impossible to install the vapor barrier in this location because the interior plywood panels are glued to wall studs and could not be glued to a plastic vapor barrier.

During my tour of Automated's facility I discovered a device (Invis-I-Nail II Paneling Fastener) that may be an answer to the vapor barrier problem. This is a strip of thin steel having short nails protruding from one side (for attaching paneling) and longer nails on the other side (for attaching the strip to frames). Installation of paneling by this method will eliminate the need for glue. Information on this device will be mailed to mobile homes manufacturers as a future Technology from Tech note. It will follow a previous note which called attention to the fact that many manufacturers were improperly installing vapor barriers.



Another device I discovered was a long strip of steel with gang nails at each end that was designed as a corner strap. This device would be excellent for attaching mobile home walls to floors, and for attaching side walls to end walls. At present, most manufacturers cut strips of aluminum from scrap siding and attach these with staples. It is the opinion of the Project Director that the gang nail strips would provide additional strength, would be more economical and could be installed more rapidly. This information will also be included in a future Technology from Tech note.

Another informative part of the trip consisted of a conference with Mr. Mike Reeder, Chief Structural Engineer, who has performed design and load tests on several types of roof trusses for mobile homes. We both agreed that many present roof truss designs will not meet load requirements of the new Georgia Standards. However, Mr. Reeder has designed and tested a Bow String Truss (assembled with gang-nails) that will exceed these requirements. This design and test data was given to me, but I don't know if I am authorized to give it to the mobile home manufacturers. I will request this permission from Mr. Reeder and if he agrees, it will be included in a Technology from Tech note.

During the latter part of my visit I met with Mr. J. Calvin Jureit, President, and his staff to discuss their proposed entry into the factory manufactured low-cost housing market. I gave them what information I could, and suggested that they contact Mr. Frank Clarke, Head of our Technical Services Section for additional information. Although this is not a function of our technology transfer project, the company has provided valuable assistance to this project and since Mr. Jureit is a Georgia Tech graduate, I feel we should render whatever assistance we can. This request has been forwarded to Mr. Clarke.

The trip was most informative and has provided information that will be valuable to our project. I will express our appreciation to Mr. Jureit and his staff by letter.

SEMHI NEWSLETTER



ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE of TECHNOLOGY

Industrial Development Division

1132 W. Peachtree Street  
Atlanta, Georgia 30309  
873-2931 Area Code 404

December 4, 1968

Mr. John B. Manley, Jr.  
Executive Vice President, SEMHI  
Suite A-1, 348 East Paces Ferry Road N.E.  
Atlanta, Georgia 30305

Dear John:

Enclosed is a rough draft of a release we would like for you to consider for your next "SEMHI Newsletter". If you agree to include this we will furnish you with a camera-ready copy.

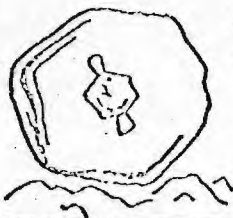
According to my present planning, we will have five technology transfers during the two year period of this project. That would mean four more releases of this type over the next eighteen months.

Please let me have your comments as soon as possible, and thanks again for your cooperation.

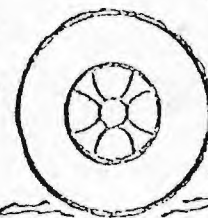
Sincerely,

Harry L. Stiltz  
Project Director

HLSam  
Enc:



## TECHNOLOGY FROM TECH



INDUSTRIAL DEVELOPMENT DIVISION  
ENGINEERING EXPERIMENT STATION  
GEORGIA INSTITUTE OF TECHNOLOGY

1132 WEST PEACHTREE STREET, N.W., ATLANTA, GEORGIA 30309

Under a grant from the United States Department of Commerce, Office of State Technical Services, with matching funds from Georgia Tech, staff members of Tech's Industrial Development Division are working on a two-year project to transfer new technology to the mobile homes manufacturing industry.

HARRY L. STILTZ, PROJECT DIRECTOR

## OUR MESSAGE FOR TODAY

AUTOMATION - A KEY TO CONSISTENT QUALITY AND PREDICTABLE PRICING

At a demonstration in Americus, Georgia, on October 22, 1968, a Bowstring Multihead Press was used to automatically assemble mobile home roof trusses. The purpose was to demonstrate the ease with which automation can be incorporated into mobile home production.

An 8 mm movie film of this demonstration is available at SEMHI headquarters and information regarding the equipment used can be obtained from Automated Building Components, Inc., 7525 N.W. 37th. Avenue, Miami, Florida, 33147.

Other firms having similar equipment are invited to send information on their equipment to SEMHI.

Georgia Tech regrets that all mobile home manufacturers in the Southeast can not be invited to all technology transfer demonstrations. However, we do not have ample facilities, so we propose to keep you informed by making technical data and movie films available through SEMHI.

AT GEORGIA TECH WE SELL IDEAS NOT PRODUCTS

WATCH FOR OUR NEXT TECHNOLOGY TRANSFER

"URETHANE FOAM INSULATION"

-70-

NEWS RELEASE



opened by the corporation under Robert Byler, president.

► Woody's Mobilehomes, Inc., Yakima, Washington, has been incorporated to engage in sales, listing \$150,000 authorized capitalization and incorporators E. L. Woodburn, Warren A. Woodburn and Virginia M. Woodburn.

## Evans Declares 15¢ Cash Dividend

The board of directors of Evans Products Company, Building Products Division, Corona, California, recently declared a cash dividend of 15 cents per share. The dividend is payable November 15, 1968 to common stockholders of record, October 28, 1968.

Evans Products Company, with executive offices in Portland, Oregon, is a diversified manufacturer and distributor of transportation equipment, building products and pre-cut homes.

## Georgia Tech Studies VH Technology

The Georgia Institute of Technology staff has undertaken a project to identify new technology particularly appropriate to the Georgia mobile home industry and to effectuate the transfer of that technology by various techniques.

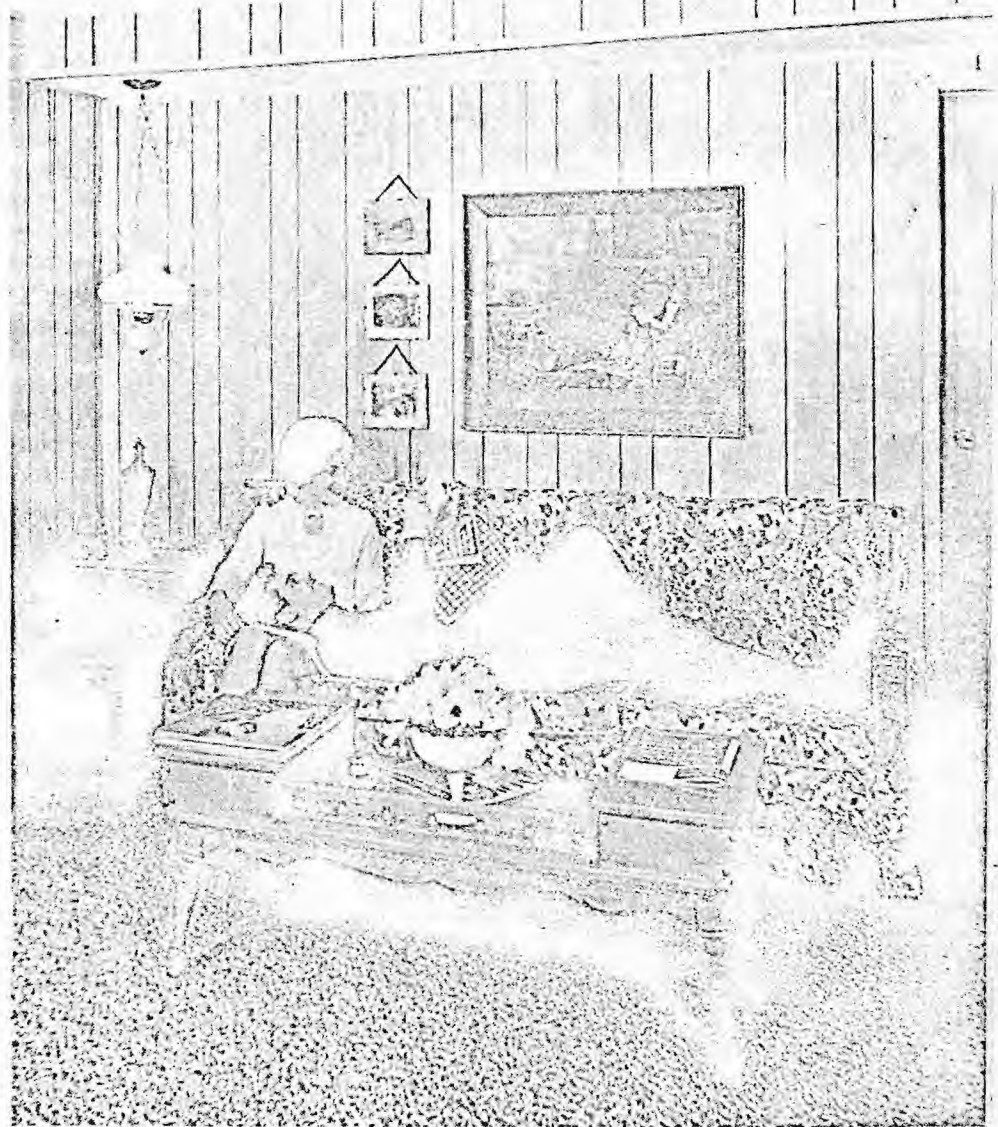
The study, entitled "A Demonstration of the Application of Technology Transfer Techniques in Two Regional Industries", is funded by a \$125,000 grant from the Office of State Technical Services of the United States Department of Commerce. The Industrial Extension Service at North Carolina State University will undertake the same technology transfer with the upholstered furniture industry in North Carolina.

Matching funds for the study are provided by both universities. As technology is developed for each industry, it will be exchanged between the two states. The project is being conducted in cooperation with the Southeastern Mobile Housing Institute, headquartered in Atlanta, Georgia.

Field personnel in the Industrial Development Division of Georgia Tech will contact a group of mobile home manufacturers in the

See GEORGIA TECH on Page 100

# The Royal is something else.



For sound value, the Ritz-Craft Venture is one thing. For sheer elegance, the Ritz-Craft Royal is something else. The Royal was designed to captivate those who wanted to indulge themselves with the ultimate in a mobile home.

The result is wall-to-wall luxury in three different decors . . . smartly styled Modern, authentic Early American and popular, romantic Mediterranean. As you would expect in a home of this class, the Ritz-Craft Royal includes many features that are extra cost options on homes of lesser quality.

# Ritz-Craft

Ritz-Craft, Inc., Argos, Ind.

Plants at Argos, Ind. Shamokin, Pa. Sarasota, Fla.

## GEORGIA TECH

*Continued from Page 99*

state. An explanation of the program will be made and new techniques developed and made available on an individual basis, according to Harry J. Stiltz, project director.

New manufacturing techniques will be disseminated to the mobile home industry manufacturers through personal discussions, seminars and publications.

George Alexander, president of the Southeastern Mobile Housing Institute, stated, "The industry wel-

comes outside agencies taking a look at our industry with the ultimate in mind of improving fabrication techniques and quality components in order to make our product available to the buying public at the lowest possible cost."

## Houston Passes MH Permit Ordinance

An ordinance requiring all dealers to obtain a yearly permit for movement of mobile homes within the city of Houston, Texas, was recently passed, according to a report from the Houston Chapter of the

Texas Mobile Home Assoc.

The fee for this permit. Each dealer is also to furnish the city, on a weekly basis, a list of all deliveries, the point of origin and the destination, whether in the city or not.

Houston requires a \$100 fee and a dealer is required to carry liability insurance of at least \$100,000 and \$25,000 for property damage.

Other requirements of the ordinance include inspection of mobile homes by the city, adequate breaker boxes. Each unit is assigned a serial number, painted on the side of the unit.

No mobile homes or trailers can be moved in the city between the hours of 7 a.m. and 4 to 6 p.m., but will be permitted to move at any hour on Sunday and legal holidays.

A special permit, without fee, is required for any units less than 10 feet wide.

Mobile homes may be placed on a vacant lot with certain conditions. The lot must be at least 50 feet wide. Mobile homes are permitted to be affixed adjacent to a residential place of business, vacant lot, block, and shall be used for residential purposes only.

The unit must be parked at least 10 feet from any building, and at least 25 feet from any street. Permits for foundations, driveway, plumbing and electricity must be obtained from the city.

Violation of any section of the ordinance results in revocation of the permit and a maximum fine of \$200.

## Clary Corp. Acquires Rushin Truss

An agreement in principle has been reached by Clary Corp., San Gabriel, California, to acquire Rushin Truss and Manufacturing Company, Garland, Texas. The company announced Hugh L. Clary, president.

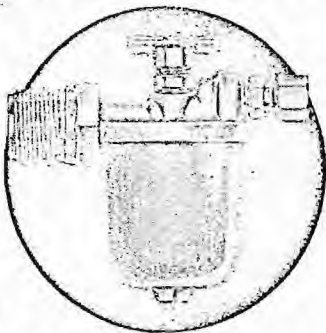
Terms of the agreement call for an exchange of stock. The transaction is subject to the approval of the Clary board, the Rushin shareholders and the appropriate regulatory agencies.

Clary is a diversified manufacturer of computers, data recording devices, gyroscopes and construction automation products. The Truss was recently formed by

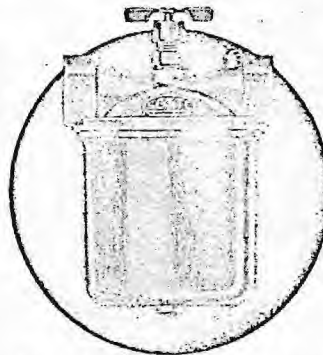


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• 3/4" outlet tube fitting  
• built-in shut-off valve  
• single screw disassembly



**Model MS-3...** List price, \$5.20 each  
Recommended that filter be placed in line before pump; gun burner type installation with ...  
• built-in shut-off valve and air vent  
• single screw disassembly  
• inlet and outlet, 3/4" N.P.T.

**MICROSTONE FILTER ELEMENTS** filter down to 1/10,000 of an inch and are easily cleaned for re-use.

- Size SS for Model F-10B ... List price, 80¢ each
- Size MS for Model MS-3 ... List price, 85¢ each



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Send me the following, postpaid:

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\_\_\_\_\_ doz. Model MS-3 Filters, List price, \$5.20 each ☐ Retailer  
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circle 185 on reader service card

MONDAY, OCTOBER 21, 1968 *Americian Times-Recorder*

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## **ROUND-UP**

THE GEORGIA TECH Industrial Division will stage a demonstration at Sumter Electric Membership Corp. Tuesday at noon to transfer information to the area mobile home manufacturers.

Louis J. Ballantyne of the Automotive Building Components, Inc., Miami, Fla., will present the demonstration on the gang nail system of truss fabrication. Managers in this area have been invited to the luncheon-demonstration.

---



WEDNESDAY, DECEMBER 4, 1968 *Americus Times-Recorder*

## Demonstration For Mobile Homes Planned

A special demonstration for the mobile home industry is scheduled Thursday at the Sunter Electric Membership Corp. auditorium by Georgia Tech's Engineering Experiment Station.

The demonstration will consist of urethane foam sprayed in place for mobile home builders to consider using as insulation for mobile homes.

The demonstration will begin at 1 p.m. following a scheduled noon luncheon.

Attendance at the technology transfer demonstration will include not only mobile home manufacturers from the Americus and Ellaville area, but electric utility representatives, personnel from the State Fire Marshal's office, and Area Planning and Development Commissions.

Isocyanate Products, Inc., of New Castle, N.J., will demonstrate their equipment.

Harry L. Stiltz, project director, will speak at the demonstration.

Under a grant from the U.S. Department of Commerce, Office of State Technical Services, with matching funds from Georgia Tech, staff members of Tech's Industrial Development Division are working on a two-year project to transfer new technology to the mobile homes manufacturing industry.

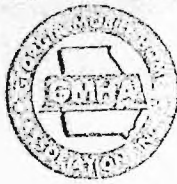
Americus Times-Recorder FRIDAY, DECEMBER 6, 1968



**SPRAY INSULATION**--Urethane foam is being sprayed on a mobile home roof in the above picture in a demonstration of the product to the mobile dealers in the area Thursday at the Sumter Electric Membership Corp. The special demonstration was under the direction of Harry L. Stitz, Georgia Tech Engineering Experiment Station. Bob Moxer, Atlanta is spraying the product with a machine handled by the Binks Manufacturing Co., Atlanta, and manufactured by Isocyanate Products, Inc., New Castle, N.J.



CORRESPONDENCE



# GEORGIA MOBILE HOME ASSOCIATION, INC.

348 E. Paces Ferry Rd.  
ATLANTA, GA. 30305  
Telephone 404-237-3311

December 3, 1968

Mr. Harry L. Stiltz  
Project Director  
Industrial Development Division  
Georgia Institute of Technology  
1132 W. Peachtree Street  
Atlanta, Georgia 30309

Dear Harry:

Thank you for your invitation to the Urethane foam insulation demonstration to be held at Americus, Georgia on 5 December 1968.

I regret that I will have to be in Louisville, Kentucky on that date, but hope that either George Alexander or Harrold Bowen will be able to attend.

Thank you again for keeping us so well informed on the progress of this important project. I look forward to seeing you again in the very near future.

Kindest personal regards.

Cordially,

GEORGIA MOBILE HOME ASSOCIATION, INC.

Ed McGill  
Executive Director

EM/nor



## HERCULES INCORPORATED

FIBERS & FILM DEPARTMENT • WILMINGTON, DELAWARE 19899

October 30, 1968

Mr. Harry L. Stiltz  
Project Director  
Industrial Development Division  
Georgia Institute of Technology  
Atlanta, Georgia 30332

Dear Mr. Stiltz:

I noticed in Science and Technology Today newsletter (#194), August 1, 1968, that your group is undertaking a study of Georgia's mobile housing industry.

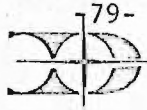
I am interested in obtaining information on the mobile home industry in Georgia and surrounding states from the aspect of number of units produced, seasons, floor area content, selling prices and like economic data. My primary interest is in floorcovering.

At the completion of your study, we would appreciate receiving a copy for further background information of the industry.

Sincerely yours.

Gordon Y. Scott  
Market Research Analyst

GIS/mcb



# The Deltona Corporation

EXECUTIVE OFFICES 3250 S.W. THIRD AVENUE • MIAMI, FLORIDA

October 23rd, 1968

Industrial Development Division  
Georgia Technical University  
Atlanta, Georgia

Dear Sir:

It has come to my attention that you are undertaking a research project in the area of mobile housing. The Deltona Corporation has recently acquired Fortune Homes, a mobile home manufacturer in Sarasota, Florida. We are also planning large, high class mobile home communities in the state of Florida. Any and all information concerning the mobile home industry is of great interest to us. I would appreciate it if you would advise me as to participation in your project.

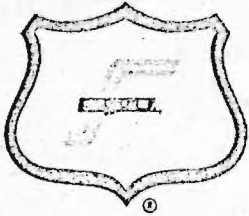
I thank you in advance for your assistance.

Respectfully,

---

F. E. Mackle, III, Ass't Vice President  
Deltona Corporation - Mobile Home Division

FEM/jep



# *FLEETWOOD ENTERPRISES, INC.*

P. O. BOX 7638, RIVERSIDE, CALIFORNIA 92503 • TELEPHONE 687-0303

September 17, 1968

Mr. Harry L. Stiltz, Director  
Special Merit Project  
Georgia Institute of Technology  
Industrial Development Division  
1138 West Peachtree Street  
Atlanta, Georgia 30309

Dear Mr. Stiltz:

We are interested in participating in your research project. The Plant Manager of our Fleetwood facility at Douglas, Georgia, is Mr. Morrie Egan. I am certain he will be very interested in your ideas and any new manufacturing techniques you develop.

Very truly yours,

FLEETWOOD ENTERPRISES, INC.

Robert D. Totten  
Vice President-General Manager

RDT:ms

cc: Mr. Morrie Egan





1904 MONROE DRIVE, N. E.  
ATLANTA, GA. 30324

October 15, 1968

Mr. Harry Stiltz  
Industrial Development Division  
Georgia Institute of Technology  
225 North Avenue, N. W.  
Atlanta, Georgia

Dear Mr. Stiltz:

It was very nice talking with you concerning your work with the mobile home industry groups. As I mentioned during our phone conversation technical information communication has been sorely lacking in the mobile home industry since its inception. The service that your group is performing I think will be invaluable to the industry as it continues to expand.

With this letter I am attaching a specification sheet on our jumbo roll specifications for our Calay rotogravure vinyl floor covering. This particular sheet I think will give you most of the information you need with reference to roll size, etc.

Again, if I can be of any help whatsoever on product information concerning floor coverings, Fiberglas Insulation materials, or ceiling products, adhesives, etc., please contact me at our office. I will make every effort to keep you up-to-date on any new product developments we have.

Sincerely yours,

E. A. Bishop  
Industry Products Division

sc

J. B. Helmer, Industry Products Division, Lancaster

NORBERT T. TIEMANN  
GUBERNATOR

JAMES W. MONROE  
DIRECTOR

# State of Nebraska

## Department of Economic Development

Box 94666 - State Capitol - Lincoln 68509

Telephone 477-8984

October 3, 1968

Reply to: Industrial Research &  
Information Service  
210 Ferguson Hall  
University of Nebraska  
Lincoln, Nebraska 68508

Industrial Development Division  
Georgia Institute of Technology  
225 North Avenue, N. W.  
Atlanta, Georgia 30308

Gentlemen:

Would you please send us any available information on your experiment in accelerating the rate of innovation in the mobile housing industry.

Thank you for your kind cooperation.

Sincerely,

(Mrs.) Diane Hansmeyer  
Coordinator of Technical Information Services

DKH:lv



GENERAL OFFICES • 3M CENTER • ST. PAUL, MINNESOTA 55101 • TEL. 733-1110

Central Research Laboratories

PLEASE REPLY TO: 3M COMPANY • CENTRAL RESEARCH LABORATORIES  
P.O. BOX 3221 • SAINT PAUL, MINN. 55101

October 2, 1968

Industrial Development Division  
Georgia Institute of Technology  
225 North Avenue N. W.  
Atlanta, Georgia

Gentlemen:

Please send me any information you have available concerning your new program intended to accelerate the rate of innovation in the mobile housing industry.

Thank you.

Yours truly,

D. E. Cadwell  
Contract Research Laboratory  
Central Research Laboratories

DEC/md



GEORGIA INSTITUTE OF TECHNOLOGY

Industrial Development Division

1132 W. Peachtree Street  
Atlanta, Georgia 30309  
873-2631 Area Code 404

October 29, 1968

Mr. William T. Orton  
Nebraska State Technical Services  
University of Nebraska  
Lincoln, Nebraska 68508

Dear Mr. Orton:

At the State Technical Services meeting in Denver you expressed interest in our project for technology transfer in the mobile homes industry. This project is still in its early stages and we are not yet able to draw conclusions from it. In fact, the first transfer was held just last week. This was a group presentation concerning a technique for fabricating trusses for mobile home roofs. We are now proceeding to transfer the same technology through the alternate means of individual contact and literature dissemination. Next month we are planning the second transfer which will involve a foamed-plastic insulation for mobile home walls.

Considerable interest has been expressed in this project and, as we are able to complete our evaluations, we will attempt to make our findings available. Also, we will attempt to send you copies of the technical material which we will be distributing to the participating mobile homes manufacturers for whatever use you may be able to make of it with your Nebraska manufacturers. Hopefully, this material will be ready within a few weeks. Should you be able to use it, we will, of course, be interested in your industry's reaction to it.

Please feel free at any time to contact us regarding this project.

Sincerely,

R. L. Yobbs, Head  
Research Services Branch

cc: Mr. F. J. Clarke  
Mr. H. L. Stiltz



ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY

Industrial Development Division

1132 W. Peachtree Street  
Atlanta, Georgia 30309  
873-2231 Area Code 404

October 29, 1968

Mr. Roger H. Mattson  
Field Services Representative  
The University of Utah  
Salt Lake City, Utah 84112

Dear Mr. Mattson:

Mr. Harold Hale has referred to us your letter of October 14 concerning the mobile homes industry. Our project in this area is still fairly new, having been initiated in July, and as yet we do not have any publishable materials. In fact, our first technology transfer was held only last week. This involved a group presentation of a technique for the fabrication of bow-string roof trusses. A second transfer is scheduled shortly to involve foamed insulation.

Subsequent to these group presentations we will also be distributing the technical literature on these techniques to certain firms and we will be glad to send you copies of these materials when they become available. However, we should point out that the construction of mobile homes differs from that of campers in many ways, and not all of these techniques will be applicable to your industry in Utah. Nevertheless, we hope they will be of some use, and we would be interested in the reaction of your manufacturers to them.

Sincerely,

R. L. Yob, Head  
Research Services Branch

cc: Mr. H. G. Hale  
Mr. F. J. Clarke  
Mr. H. L. Stiltz





ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY

Industrial Development Division

1132 W. Peachtree Street  
Atlanta, Georgia 30309

October 29, 1968

Dr. Melvin W. Lifson  
Lifson-Kline Associates  
10335 Santa Monica Boulevard  
Los Angeles, California 90025

Dear Dr. Lifson:

Thank you for your letter of October 21 concerning our State Technical Services program. I did not hear from Dr. Kline last week; apparently he was not able to contact us during his visit here.

Our project for technology transfer in the mobile home industry is still in its very early stages yet and we are not yet able to draw conclusions from it. In fact, the first transfer was held just last week. This was a group presentation concerning a technique for fabricating trusses for mobile home roofs. We are now proceeding to transfer the same technology through the alternate means of individual contact and literature dissemination. Next month we are planning the second transfer which will involve a foamed-plastic insulation for mobile home walls.

Considerable interest has been expressed in this project and, as we are able to complete our evaluations, we will attempt to make our findings available. As you know, North Carolina State University is conducting a parallel project in the furniture industry. They are presently at about the same stage in that project that we are in ours.

We have been rather surprised at the amount of interest shown in the mobile home project, not so much for the techniques of technology transfer involved, although that was the original reason for the project, but for the low-cost modular housing implications.

Certainly we will be most interested in hearing of your work with the Rocky Mountain Technical Services Council. I gather that this group has been fairly successful in their approach to a regional effort and this is something which interests us in the Southeast also.

Sincerely,

R. L. Yobs, Head  
Research Services Branch

cc: Mr. F. J. Clarke  
Mr. H. L. Sciltz  
Mr. H. G. Hale

COPY



233 BROADWAY, NEW YORK, NY 10007 TELEPHONE (212) 267-5300

AIR MAIL

November 8, 1968

Mr. Harry Stilz  
Project Engineer  
GEORGIA TECH  
INDUSTRIAL DEVELOPMENT DIVISION  
1132 W. Peachtree St.  
Atlanta, Ga. 30309

Dear Mr. Stilz:

Mr. W. J. Toland, from our Atlanta Office, has suggested that I contact you concerning your current interest in the development of mobile home manufacturing in the state of Georgia.

As you may know, we are currently suppliers to this industry through our Honeycomb Division, who is marketing a concept of modular panels to both mobile home and travel trailer manufacturers.

We would like to discuss our concept with you in more detail, and I would appreciate it if you could arrange to see our area representative, Mr. W. E. Easley, who will be calling you in the near future for an appointment.

Very Truly yours,

M. F. NELSON  
Marketing Manager  
Honeycomb Division

NFN:jmv

QUARTERLY REPORT NO. 3 (January 1, 1969, to April 1, 1969)

A DEMONSTRATION OF THE APPLICATION OF TECHNOLOGY  
TRANSFER TECHNIQUES TO TWO CONTRASTING REGIONAL INDUSTRIES

A joint project with the Industrial Extension Service,  
School of Engineering, North Carolina State University

Prepared for

OFFICE OF STATE TECHNICAL SERVICES  
U. S. DEPARTMENT OF COMMERCE

by Harry L. Stiltz, Project Director  
INDUSTRIAL DEVELOPMENT DIVISION

Georgia Tech Project B-343  
OSTS Grant No. 1310-001

Engineering Experiment Station  
GEORGIA INSTITUTE OF TECHNOLOGY  
Atlanta, Georgia



1969



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Harry L. Stiltz  
Project Director

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North Carolina State University

Industrial Development Division  
Engineering Experiment Station  
GEORGIA INSTITUTE OF TECHNOLOGY  
April 16, 1969

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## BACKGROUND

### Joint Program

In June 1968, the office of State Technical Services, U. S. Department of Commerce, awarded grants totaling \$123,431, to be matched equally by state funds, to the Industrial Development Division (IDD) of the Georgia Institute of Technology and the Industrial Extension Service (IES) of North Carolina State University for a two-year joint Special Merit Project, effective July 1, 1968. The purpose of the program is to demonstrate the application of technology transfer techniques to two contrasting regional industries. In North Carolina, the upholstered furniture industry, a traditional industry with a reputation for being relatively slow to take advantage of technological change, was selected. In Georgia, the mobile home industry, an emerging industry generally considered to be technically advanced and receptive to innovation, was chosen.

### Objectives

The overall objectives of the joint program are to identify the most effective methods of technology transfer and to determine whether they differ for traditional and emerging types of industry.

Objectives of the Georgia Tech segment of the program (OSTS Grant No. 1310-001) are as follows:

1. To identify new technology appropriate to the mobile home industry within the state of Georgia, and to effectuate the transfer of that technology by various techniques.
2. To evaluate the relative effectiveness of the various techniques of technology transfer.

### Plan of Procedure

The first month of project activity in 1968 was devoted to preparation of a Plan of Procedure which was included in Quarterly Report No. 1 (July 1, 1968, to October 1, 1968). The plan set forth a detailed schedule of activity for the first year of the project and was divided into three phases.

Phase I - Initial Planning and Technology Search. Phase I was completed on schedule during the first quarter and is fully covered in Quarterly Report No. 1.

Phase II - First and Second Technology Transfer. Phase II was scheduled for completion during the third quarter and was partially reported in Quarterly Report No. 2 (October 1, 1968, to January 1, 1969). Except for extension of time for technology transfer effectiveness study, Phase II was completed on schedule and is reported herein.

Phase III - Third Technology Transfer and Project Evaluation. Phase III was started on schedule during the third quarter, but is not scheduled for completion until the end of the first year of the project (June 30, 1969). It is therefore only partially reported herein.

#### Summary of First Quarter Activities

The first quarter was devoted to procedures planning, publicity releases, coordination with North Carolina State University, coordination with Industrial Development Division (IDD) field personnel, visits to mobile home manufacturing plants in Georgia, participation in the Southeastern Mobile Housing Institute (SEMHI) Convention, attendance at the Man and His Shelter Conference at the National Bureau of Standards, selecting contact companies, gathering and studying literature on new technology, and preparation for the first technology transfer.

#### Summary of Second Quarter Activities

The second quarter was devoted to our first technology transfer (use of the gang-nail system of roof truss fabrication), evaluation of transfer effectiveness of the first transfer, and selection and transfer of our second technology (urethane foam insulation). A report on transfer effectiveness of the second transfer is included herein.

## THIRD QUARTER ACTIVITIES

### Phase II

A copy of the "Technology from Tech" data used for the second technology transfer, the use of sprayed-in-place urethane foam insulation, was included in Quarterly Report No. 2 and is also included in this report for convenience. At the end of the second quarter, this transfer had been completed, but no results had been obtained.

The remainder of Phase II, scheduled for completion during the third quarter, includes evaluation of effectiveness of the second technology transfer, continuation of new technology search, and a coordination meeting at North Carolina State University. All work was completed on schedule for this phase of the project.

### Phase III

This phase was started on schedule midway through the third quarter, but is not scheduled for completion until the end of the first year. However, it is felt that the portion of Phase III (approximately six weeks) falling within the third quarter was the most important activity during the first year of the project. It was during this period that we paused to reflect on our accomplishments thus far. We had reached a point where we could analyze the results of transferring two entirely different types of technology, one being a well-proven technology in widespread usage in other industries (gang-nail technology) and the other being a lesser-known, infrequently used technology (urethane foam insulation). We also were able to partially evaluate effectiveness of the three types of technology transfer -- group presentation, "written" transfer, and direct personal transfer.

As shown in the remainder of this report, our evaluation resulted in a complete reversal in the type of technology sought for the third transfer. We had originally planned to transfer three technologies during the first year, each being progressively more complex; however, we have now decided to reverse this procedure and have selected a technology less advanced than the first two for our third transfer.

### Results of First Technology Transfer

As stated in Quarterly Report No. 2, our evaluation had shown that the mobile home industry is a rapidly growing, highly profitable industry that

will not respond to technological changes rapidly. Supply has not kept pace with demand, so the industry is more concerned with increasing production than in introducing new technology.

We also noted that a rapidly growing industry is normally confronted with a shortage of management personnel that further restricts ability of the industry to keep pace with customer demand for its products. This has been especially true in the mobile home industry and has resulted in forced use of inexperienced management personnel. These inexperienced personnel of necessity have to devote most of their time to learning existing manufacturing techniques. Therefore, in most instances, they are reluctant to make changes until they are firmly established in their management positions.

It was decided, then, to extend our evaluation periods beyond the originally scheduled six weeks before making preliminary evaluation of transfer effectiveness for each technology. This change in procedure has enabled us to reach conclusions regarding the first technology transfer (gang-nails) that were not apparent at the end of the second quarter. At that time, no company had adopted use of the gang-nail system of roof truss fabrication, and no company had adopted use of gang-nails in other applicable areas (such as floor stringer splicing, wall-to-wall ties and wall-to-floor ties) as a result of the technology transfer. However, that situation changed considerably during the third quarter.

North Carolina State University reports that three of their 13 mobile home contact companies are now using gang-nails and a fourth company is in the process of ordering two gang-nail roof truss systems. Transfer to these companies was made by direct mail, and information on action taken was obtained by personal visits. It will be interesting to see if the personal visits will encourage implementation of gang-nail usage by the other companies.

Four mobile home manufacturers in Georgia adopted the use of gang-nails during the third quarter and another is preparing to set up a separate plant to supply gang-nail roof trusses to its several mobile home plants. (See Appendix A.) The first four were newly formed companies to whom transfer had been made by direct mail and followed up by subsequent visits.

None of the four manufacturers who attended the first technology group presentation has adopted use of this technology. Also, neither of the two manufacturers to whom a personal transfer was made has adopted it. Summarizing our evaluation of the first technology transfer, we find the following facts:



1. None of the 29 contact companies (in Georgia and North Carolina) had adopted this technology at the end of the second quarter (approximately six weeks after completion of the transfer).

2. Nine companies adopted the technology during the third quarter.

3. All nine of the receptive companies were originally contacted by "written" transfer.

4. Five of the nine adopted the technology after follow-up personal visits, whereas the other four received only the written material.

At this point, we can tentatively conclude that the most effective method of transfer for the first technology was the "written" transfer. However, we cannot rule out the "direct personal" transfer since (1) five of these companies adopted the technology after the first follow-up visit (we shall subsequently determine if the personal visits influenced these companies) and (2) the number of sample companies selected for the "direct personal" transfer was too small (we increased this number considerably for the second technology transfer).

#### Results of Second Technology Transfer

The second technology transfer was completed during the second quarter and results have been continuously monitored during the third quarter. The original "Technology from Tech" data that were used for this technology (urethane foam insulation) were included in Quarterly Report No. 2, but are repeated herein (Appendix B) for convenience.

An analysis of transfer effectiveness for this transfer resulted in a modification of our original plans for selection of a third technology. Most manufacturers were impressed with the use of urethane foam as an insulating material, but felt that the process of application was too sophisticated to be incorporated into their production facilities. We therefore decided that we should select a simple technology for the third transfer in order to obtain at least partial acceptance. Otherwise, we would be unable to attain objectives of the project (determination of the best method for transferring technology).

Appendix C shows that 14 of the 20 companies receiving the transfer in Georgia have definitely decided not to implement this process. However, the North Carolina State University project director reported that requests for a demonstration of this process in North Carolina were so numerous that he has arranged one for his mobile home contact companies. The same firms (Isocyanate

Products, Inc., and Binks Manufacturing Company) that conducted the demonstration in Georgia have agreed to conduct another in North Carolina.

The project director proposes to continue supplying data on urethane foam to the contact companies from time to time through "Technology from Tech" releases. Although the mobile home industry, per se, may never adopt this technology, it is quite possible that those manufacturers who propose to enter the modular (low-cost) home industry may find it to be a useful technology. The modular homes must be approved by FHA, whereas mobile homes do not since the FHA will not insure mortgages on mobile homes. A few Georgia mobile home manufacturers presently are making plans to produce modular homes; as they progress in their planning, they will find that many materials and construction techniques currently utilized in mobile home manufacturing will no longer be acceptable. The presently used thin fiber-glass insulation that does not contain a vapor barrier will not be acceptable. Neither will FHA accept the present methods of installing this fiber glass. Therefore, a more expensive fiber-glass batt (thicker, and including a vapor barrier) that must be completely stapled to wall studs from top to bottom will be required (in most mobile homes the fiber glass is not fastened at all and consequently slides down from the top of the wall during transit).

Some of the objections to using urethane foam insulation included the possibility of increased costs. The project director computed costs of using this process versus using fiber glass and found that the cost would be increased approximately \$50.00 for a 12' x 60' mobile home. This is not an appreciable cost, since the mobile home owner would undoubtedly save that much in fuel expenses within the first year. However, to the average manufacturer who produces about 2,000 mobile homes per year, it represents a considerable increase in cost. If the manufacturer could successfully convince the dealer and the dealer could successfully convince the customer, and if the increased cost were absorbed by the customer, everyone would benefit. The computed cost comparison data were not distributed to the manufacturers because Georgia Tech cannot put itself in the position of comparing costs on one company's product with another. However, the manufacturer should be able to make this comparison without difficulty since cost data on urethane foam were provided to those who requested it.

Another objection to using urethane foam insulation was that it would take too long to apply. This objection is partially valid since some provision (like enclosing the mobile home with a curtain wall) would have to be made because of

"over-spray" affecting adjacent areas. However, the project director conducted a time-and-motion study at one plant and found that it takes about the same time to apply the foam as to install fiber glass.

Appendix D is a representative field memo of follow-up visits to three manufacturers. Each of these manufacturers was represented at the group presentation (demonstration), and their comments have been discussed in the preceding paragraphs.

Although the urethane foam technology appears to be unacceptable to the mobile home industry, study of this technology has produced valuable information for use in the Housing Resources Center at Georgia Tech. This center has already received a valuable input from Union Camp Corporation (Appendix E) and is presently working with this corporation and an architectural firm on the use of Urecomb panels in factory manufactured housing.

#### Selection of Third Technology

As a result of studies conducted by the North Carolina State University project director and a subsequent technology transfer, we were made aware of Du Pont's new Teflon-S (see Appendices F and G) low-friction, nonwetting finish. Since we were searching for a simpler technology for our third transfer, and since a mobile home contains as large a percentage of wood as does a typical unit of upholstered furniture, we decided to investigate this material in more detail.

After reading the North Carolina State University data and talking to a Du Pont representative, we selected the new material for our third technology transfer. However, in view of our past experience in attempting to transfer new technology to the mobile home industry, we decided to involve the industry in tests of Teflon-S rather than to rely solely on results obtained by Du Pont and North Carolina State University. We therefore obtained five saw blades and a shaperhead from one mobile home manufacturer and had them coated with Teflon-S. (See Appendix H.) These blades were then returned to the manufacturer to be reinstalled for evaluation tests.

Prior to the end of the third quarter, two reports had been received from field personnel. (See Appendices I and J.) Results thus far indicate that the blades have lasted several times longer than they did prior to being Teflon-S coated. We therefore propose to use this technology for our third transfer early in the fourth quarter.

## Technology Transfer Questionnaire

As a means of determining industry acceptance of the technology transfer project, we mailed a questionnaire (Appendix K) to all mobile home contact companies in Georgia and North Carolina. At the end of the third quarter, we had received 15 of the 29 that were mailed.

The numbers in front of each answer in the sample questionnaire (Appendix K) represent the number of companies checking those answers. These do not total 15 for each question since some companies checked more than one answer. Several representative responses (see Appendices L, M, and N) are also included, and our action on these suggestions and requests has been as follows:

1. Appendix L - Company Unknown

- a. Inventory Control. An inventory control system for the mobile home industry is being prepared by Georgia Tech.
- b. Hydraulic Scaffolds. This was previously investigated as a possible technology transfer but proved to be too expensive. Other more economical methods are more feasible, and data on these are available from STS.
- c. Time and Motion Studies. STS will assist with these when requested.
- d. New Type Wood and Metal Fasteners. This area is being investigated for a possible future technology transfer. As a starting point, specifications for cadmium-plated screws will be obtained from a company like General Motors and reviewed for applicability to the mobile home industry.

2. Appendix M - Armor Homes, Inc.

- a. Tangible Items. We had given some thought to an intangible item for our third technology transfer, but most manufacturers indicated a preference for tangible items, so we selected the Teflon-S as previously discussed.

3. Appendix N - Cavalier Homes, Inc.

- a. Prefinished Floor Decking. This has been discussed with the Georgia-Pacific Corporation, but does not appear to be feasible with presently available materials. Further investigation will be made when searching for new technology.



- b. Substitute for Steel Roof. This area has been under investigation by STS and under this special merit project because of the many roof leak complaints by mobile home dealers. Discussions have been held with Reynolds Aluminum and with several fiber-glass moulding companies. These investigations will be continued.
- c. Value Analysis of Sidewall Belt Rails. (A belt rail is a spliced but continuous wooden member, usually 2" x 2", running longitudinally around the periphery of the mobile home.) This request for a value analysis was forwarded to Georgia Tech's School of Architecture and their reply was forwarded to Cavalier Homes, Inc. (See Appendix O.)

The foregoing discussion of our technology transfer questionnaire is a good indication of the volume of technical data generated by this project that is applicable to our other STS activities. Technical questions from mobile home manufacturers are investigated by the project director only when it appears that such investigation may lead to discovery of new technology useful to the special merit project.

#### Coordination with North Carolina State University

A project coordination meeting was held at High Point, North Carolina, during the third quarter. This meeting was originally scheduled for the second quarter, but was rescheduled so that more conclusive data could be presented by both project directors. A trip report on the meeting is contained herein. (See Appendix P.)

Other coordination activities included setting up a system whereby each project director mails technology data directly to contact companies in the other state, with a copy to the project director. However, through continuous communication, each project director is aware of the type of technology transfer that is being considered prior to the actual transfer.

As a result of publicity received in the Southeastern Mobile Housing Institute's newsletter (Appendix Q), we received a request from a company in North Carolina to review movie films of our first technology transfer demonstration. These films were mailed to the project director at North Carolina State University (see Appendix R) for handling.



## CONCLUSION

### A Reflection on the Transfer Process

During the past nine months, we have learned much about technology transfer that is contrary to our original thoughts at the beginning of the project. For example, we had originally thought we could proceed throughout the project by transferring technology at progressively more advanced levels. However, it was readily apparent at the conclusion of our second technology transfer that this approach was invalid, and as our project progresses, it is not unlikely that we will discover a need for establishing a technical level of competence (to a greater extent than originally anticipated) within an industry prior to attempting any level of technology transfer. However, as we have seen in many instances, technical competence levels vary considerably from company to company, thereby further complicating the desire to establish an orderly transfer of technology.

The project director personally visited many mobile home manufacturers during the first six months of the project and also attended the Southeastern Mobile Housing Institute Convention, as a means of getting acquainted with top management personnel in the industry. Subsequent visits were made by the project director and field personnel in an attempt to select middle management personnel who appeared to be most receptive to the project and who had the authority to innovate. However, it was soon apparent that this industry essentially has no middle management, and most discussions concerning new technology have had to be conducted with top management. This gap between top management and the working level presents another obstacle to an orderly transfer of technology.

At this point in the project it is beginning to appear that the technology transfer agent must essentially fill the role of middle management in this type of industry. He must convince the working level that automation provides job security through enhancement of the company's competitive position, while simultaneously convincing top management that the equipment required for automation will provide a fair return on his investment and that it can be readily incorporated into the present production process.

Even though we are attempting to determine which of three technology transfer processes is most adaptable, it appears that we must use a continuous "hard sell" approach. The present project lends itself well to this approach since follow-up visits on a particular technology transfer can be used as "selling" visits for a previous technology transfer. For example, we have continued to

provide additional data on the use of gang-nails long after the original transfer, and the results have shown a considerable improvement in innovation.

We propose to continue a policy of including reflections on the transfer process in each subsequent quarterly report. This should prove valuable in preparation of a final report for the project since we can readily trace those factors on which our opinions of the process were founded.

#### Fourth Quarter Plans

At the end of the third quarter, our original schedule is still being adhered to (see Quarterly Report No. 1). A new technology, Teflon-S, has been selected and data are being prepared to transfer this technology prior to the end of April 1969.

Interest in the project continues to be expressed by outside firms and institutions too numerous to include in this report. Copies of correspondence with the University of Nebraska (Appendix S) and the University of Utah (Appendix T) are included, and a few companies that have offered assistance are mentioned elsewhere in the report.

Fourth quarter activities will include transfer and evaluation of our third technology transfer, attendance at the Southeastern Mobile Home Show in Atlanta, a coordination meeting with North Carolina State University, and preparation of the first annual report.

## APPENDICES

APPENDIX A

ENGINEERING EXPERIMENT STATION  
GEORGIA INSTITUTE OF TECHNOLOGY

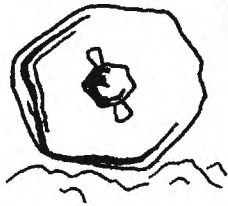
☐ Visit at E.E.S.    ☒ Visit at Firm or Agency    ☐ Telephone Conversation

Mickey Bell, Production Manager  
or Agency Plantation Homes Industries, Inc.  
ess U. S. Highway 19, Camilla, Ga. 31730  
phone No. \_\_\_\_\_ Date 1-14-69 Hour \_\_\_\_\_  
Bill Studstill Project or Unit Follow-up on Foam Technology Transfer  
Gang-Nail Technology

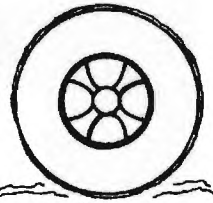
Visited with Mickey Bell, Production Manager. They have plans to establish  
Facility in Camilla to fabricate their trusses and also possibly fabricate aluminum  
ing. Therefore, they are still interested in our gang-nail technology and probably  
ll be back in touch with us for some help in this area.

Mickey Bell was not aware of the urethane foam technology. Evidentially  
Jim Allen, whom it was transferred, did not pass it along to Mr. Bell.

During this visit I talked at length with Mickey Bell about areas where  
could help them in their business and he seemed quite interested. I believe he  
l be calling on us for quite a bit of help in the future.



# TECHNOLOGY FROM TECH



INDUSTRIAL DEVELOPMENT DIVISION  
ENGINEERING EXPERIMENT STATION  
GEORGIA INSTITUTE OF TECHNOLOGY

1132 WEST PEACHTREE STREET, N.W., ATLANTA, GEORGIA 30309

Under a grant from the United States Department of Commerce, Office of State Technical Services, with matching funds from Georgia Tech, staff members of Tech's Industrial Development Division are working on a two-year project to transfer new technology to the mobile homes manufacturing industry.

HARRY L. STILTZ, PROJECT DIRECTOR

## OUR MESSAGE FOR TODAY

### CONSIDER URETHANE FOAM INSULATION FOR MOBILE HOMES

Did you know that Urethane foam is an excellent insulating material? Have you considered using it in your mobile homes? Did you know you can spray it on the walls, floor and ceiling between the framing and that it expands to thirty times its original volume while being sprayed? If you would like additional information drop us a line.

### TECHNOLOGY IS WHERE YOU FIND IT

#### 1. Let's borrow technology from the U. S. Navy:

In 1966 the U. S. Government developed the concept of packaging military equipment with foam chemicals in such a manner that the chemicals would foam in mid-air as the equipment was parachuted from planes.

#### 2. Let's borrow technology from the auto industry:

The U. S. automobile industry uses both flexible and rigid foams in visors, arm rests, seats and other areas. The Volkswagen uses a large block of foam in the firewall and is introducing foam as a poured-in core for hollow aluminum tubular framing to cut vibration, deaden sounds and add rigidity.

Con't



3. Let's borrow technology from the railroad industry:

A passenger train that has been in successful and continuous use in Germany since 1961 uses integral foamed panels for sides, roof and (with structural reinforcement added) floor. The manufacturer has reported excellent performance with increased interior space (due to thinner walls), quieter operation and a weight reduction of over 30%.

4. Let's borrow technology from the construction industry:

Sprayed-in-place foam has been gaining rapidly in residential and industrial insulation. These applications have included pouring of foam around hot and cold water pipes in a 35-story building in Chicago; foamed-in-place insulation for a 21-story building in Buffalo, N. Y., foamed-in-place insulation for a 16-story apartment building in Alexandria, Va., and many other similar applications.

Under section 233 of the National Housing Act, an experimental home in Minneapolis is using Urethane foam, reinforced with plywood and RP (rigid plastic) as a structural insulant, as well as poured-in-place foam for insulation of exterior walls.

As further indication of acceptance of Urethane foam, the FHA has approved Urethane backed siding for home construction, and the State of California has approved Urethane panel relocatable school construction.

Now that we have borrowed the technology of using Urethane foam as insulation, let's see what advantages it has to offer the mobile homes manufacturing industry. The next few pages present some interesting "food for thought."

ADVANTAGES OF RIGID URETHANE FOAM INSULATION FOR MOBILE HOMES

1. Urethane foam is produced from liquid components that have a total volume 1/30th of the expanded foam (consider the savings in storage and materials handling).
2. Urethane foam provides from two to four times the insulation value of other insulating materials. (One half inch of Urethane foam will replace one inch or more, of other conventional insulating materials).
3. Urethane foam can be applied to sidewalls, floor and roof by spraying (one man can spray a 1/4 inch layer of Urethane foam over a 1200 square foot area in 30 minutes).
4. Urethane foam is highly resistant to water and water vapor (consider the savings in eliminating vapor barriers).
5. Will support lower cost aluminum wiring and eliminate many present problems of aluminum wire breakage during transit. (If sprayed after wiring installation.)
6. Urethane foam has a compressive strength of 20 to 60 pounds per square foot. (Consider the additional rigidity obtainable for sidewalls and roof. Also consider the "Effective Flexural Rigidity" requirements contained in the new Georgia Rules and Regulations for Factory Manufactured Movable Homes. If you don't meet the minimum  $\overline{EI}$  requirement it's possible you can avert a re-design merely by using Urethane Foam insulation.) A sample calculation is shown below:

(a) Typical Calculation of Mobile Home Effective Flexural Rigidity

$$\overline{EI}_f = 36(L_f)^3 (P/y)_f \text{ lb-in}^2 \quad \begin{array}{l} \text{(see Part I, paragraph 6.11,} \\ \text{Georgia Rules \& Regulations for} \\ \text{Factory Manufactured Movable Homes)} \end{array}$$

## (1) Assumptions for a 12'x60' mobile home

1.  $L_f = 40'$
2. Test Load  $P = 500 \text{ lb}$
3. Deflection  $y = 0.3''$

Solve for  $\overline{EI}_f$ :

$$\begin{aligned} \overline{EI}_f &= (36)(40)^3 \left( \frac{500}{0.3''} \right) \\ &= (1.2) (64) (5) \times 10^7 \\ &= 38.4 \times 10^8 \quad \text{(Not Acceptable)} \end{aligned} \quad \begin{array}{l} \text{(see Figure 1 Appendix} \\ \text{1, Georgia Rules and} \\ \text{Regulations)} \end{array}$$

## (2) Change assumption for (y) to 0.1":

$$\begin{aligned} \overline{EI}_f &= (3) (38.4) 10^8 \\ &= 115.2 \times 10^8 \quad \text{(Acceptable)} \end{aligned}$$

In this case, the maximum allowable deflection would be approximately 0.1". If the deflection is greater than 0.1", it is possible that using Urethane foam insulation will provide sufficient structural strength to reduce the deflection to 0.1" or less.

# APPENDIX B Cont.

7. Urethane foam fills all voids and adheres readily to any clean surface (See Heat Loss Certificate requirement - Part I, Paragraph 7.5, and Airtightness of Supply Duct Systems - Part III, Paragraph 6.10.4, Georgia Rules and Regulations)

8. The new Georgia Rules and Regulations require the following minimum resistance (R) factors:

<u>Type of Fuel</u>	<u>Wall</u>	<u>Ceiling</u>	<u>Floor</u>
Gas or Oil	5.5	8.2	5.5
Electric	6.5	13.0	12.0

The total R value is obtained by adding the insulation R value to the R value of mobile home construction. Typical Construction R values, excluding framing, have been calculated to be:

Sidewalls R=2.0, Floor R=3.0, Ceiling R=3.0

However the Rules and Regulations state that the actual Construction R values must be calculated.

a. To determine the required insulation R factors, let's assume the calculated Construction R value equals the typical Construction R value. The minimum required insulation R factors would then be:

<u>Type of Fuel</u>	<u>Wall</u>	<u>Ceiling</u>	<u>Floor</u>
Gas or Oil	5.5-2.0=3.5	8.2-3.0=5.2	5.5-3.0=2.5
Electric	6.5-2.0=4.5	13.0-3.0=10.0	12.0-3.0=9.0

b. Since one inch of Urethane foam has an R factor of 9.0, the following foam thicknesses would be required:

<u>Type of Fuel</u>	<u>Urethane Foam Thickness (Inches)</u>		
	<u>Wall</u>	<u>Ceiling</u>	<u>Floor</u>
Gas or Oil	0.39	0.58	0.28
Electric	0.50	1.11	1.00

9. The Urethane chemicals require less than 5% of the storage space required by conventional insulations.

a. Assuming that a mobile home manufacturing plant produces eight 12'x60' (gas or oil heated) units per day and that a 10-day supply of Urethane is stocked, storage space requirement would be as follows:

Urethane foam volume per unit:			
Walls	= 10 x 144 x $\frac{.39}{12}$	=	47 cu. ft.
Ceiling	= 12 x 60 x $\frac{.58}{12}$	=	35 cu. ft.
Floor	= 12 , 60 x $\frac{.28}{12}$	=	17 cu. ft.
Total foam req'd			= 99 cu. ft.

## APPENDIX B Cont.

Since the Urethane foam is 30 times greater in volume than the chemicals, storage space required would be:

$$\frac{99}{30} = 3.3 \text{ cu. ft. (25 gallons) per unit.}$$

For a 10-day supply the storage space required is:

$$3.3 \text{ cu. ft.} \times 8 \text{ units/day} \times 10 \text{ days} = 246 \text{ cu. ft. (2000 gallons)}$$

# urethane in building

SECTION

U/B 1-1

## RIGID URETHANE FOAM'S HIGH INSULATING EFFICIENCY YIELDS SAVINGS IN HEATING AND AIR-CONDITIONING COSTS FOR ALL TYPES OF BUILDINGS

Rigid urethane foam has been called "super-insulation" because, inch for inch, it provides two to four times the insulation value of other insulating materials. (See chart at right.)

Highly resistant to water and water vapor, it retains its insulation effectiveness indefinitely.

Because it is more efficient, urethane foam can maintain insulating values at about half to one-third the thickness of other insulating materials. Among the advantages this provides are shipping and handling savings and thin-wall construction, leading to more usable interior space.

When applied as a liquid chemical system, urethane foam adheres tightly to virtually all building materials, filling and sealing the space it occupies. Thus, no heat leaks are permitted.

Rigid urethane is lightweight, yet it has remarkable strength for its weight.

Urethane foams with self-extinguishing and flame-retardant ratings are readily available.

### URETHANE SEALS WALLS, ROOFS, FLOORS, STOPS HEAT / COLD LOSSES EVERYWHERE

Rigid urethane foam's excellent insulating ability, unique strength and availability as a slab material or as a liquid system which can be installed by several methods are key reasons for its selection for these insulation assignments:

**Masonry Walls:** Using rigid urethane foam, a builder can insulate and install a plaster base in a single, cost-cutting operation that can eliminate the need for furring and lathing.

**Cavity Walls:** A high insulating ability and availability as a liquid system make urethane foam a natural for cavity wall insulation. Shredded fibrous materials, for example, dumped into cavity wall spaces may hang up on in-wall obstructions such as masonry wall ties, causing insulation voids. Up to 9-ft. high cavity walls can be filled with urethane foam at one time to form void-free insulation that seals the interior, increases the wall's strength. Boardstock also works well here.

**Roof Insulation:** Roofs are subjected to more weather factors which affect inside environmental conditions than any other exterior surface. In addition to its value as insulation and as a moisture vapor barrier, urethane foam also helps maintain the structural integrity of the roof system. Urethane's light weight can reduce the dead load of a roof by up to 75%, leads to savings in

COMPARATIVE INSULATING EFFICIENCY

Material	k* factor	R for 1-in. thickness	Thickness for Equivalent Insulating Value
Urethane	0.11	9.0	1"
Glass Fiber	0.22	3.8	2"
Wood Fiber	0.27	3.7	1.9"
Styrene Foam	0.28	4.2	2.8"
Mineral Wool	0.3	3.3	1.9"
Foam Glass	0.38	2.5	3.8"
Vermiculite	0.48	2.08	3.4"

\*The lower its k factor and the higher its R, the more effective is an insulating material.

Rigid urethane foam can provide savings in building costs as well as in operating costs.

It is the only building insulation material that can be obtained as boardstock, as a structural core in building panels or as a liquid chemical system which can be installed on site by the pour, froth or spray techniques. The designation "rigid urethane foam" covers all types.

installation time and labor. It has good compressive strength to resist heavy snow loads.

Urethane has been applied to roofs by installing boardstock and by pouring-in-place. Each type is coated or covered with built-up roofing. Urethane, faced with roofing felt, is used like fibrous board roof insulation. Sprayed urethane is solving the problem of insulating unusual shapes, including corrugated, arched and elliptical roofs.

**Perimeter Insulation:** Rigid urethane foam sharply reduces heat transfer along a building's concrete foundation. Here, urethane's chemical inertness and moisture resistance are most important.

**Residential Insulation:** Urethane foam can be spray-applied to insulate basements, walls and attics. Besides providing excellent insulating ability, it seeks out and seals difficult-to-insulate areas such as above windows and in narrow spaces around windows and doors. Urethane boardstock offers the same high insulating effectiveness and is also widely used in residential construction.

**Other Uses:** Urethane foam is also used to insulate crawl spaces, cathedral ceilings, pipes and other building elements. This can be done on site with a liquid system or with preformed materials such as pipe insulation jackets which are delivered from the manufacturer ready for installation.



Rigid urethane foam is a cellular plastic that is formed by the reaction of two liquid chemicals (isocyanates and polyols) in the presence of certain additives and catalytic agents.

The mixture begins to foam instantly and quickly expands to about 30 times its original volume. The self-hardening foam completely fills the area, space or cavity to be insulated.

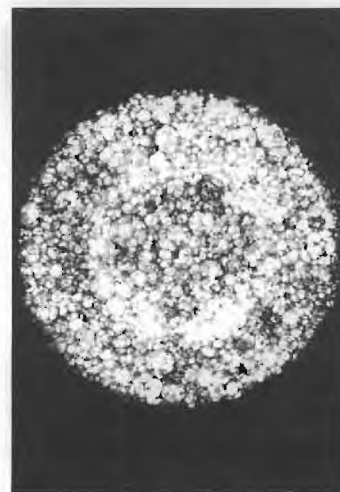
The chemical reaction which creates the foam takes place in the factory in the case of urethane boardstock or on location in the case of foamed-in-place urethane.

Wherever it is made, the foam contains many tiny cells, each filled with a minute quantity of gas produced by the foaming process. The gas, trapped in the cells and occupying more than 95% of the foam's total volume, plays a key role in giving rigid urethane its insulating properties. The gas has extremely low heat conductance, bars most conductive vapors and keeps to a minimum internal convection.

Rigid urethane foam is not a single material,

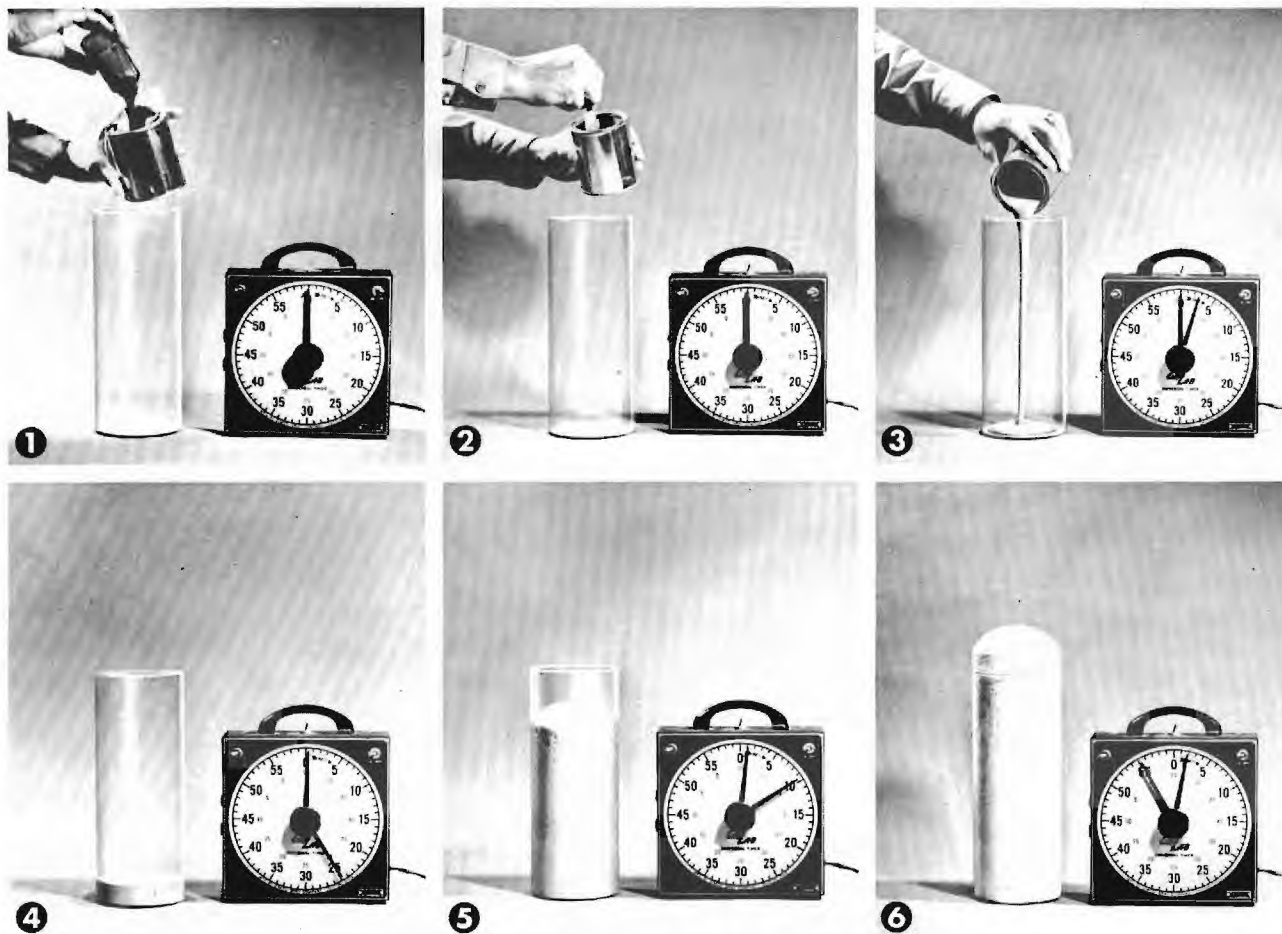
#### Photomicrograph

shows the network of closed cells which gives rigid urethane foam its unusual strength and superior insulating value. There are about 1,000,000 cells in one-inch urethane cube.



but rather a class of materials with different formulations and different densities for different applications. Urethane foams in widest commercial use have densities—ratio of gas to plastic—of 1.5 to 3.0 pounds per cubic foot.

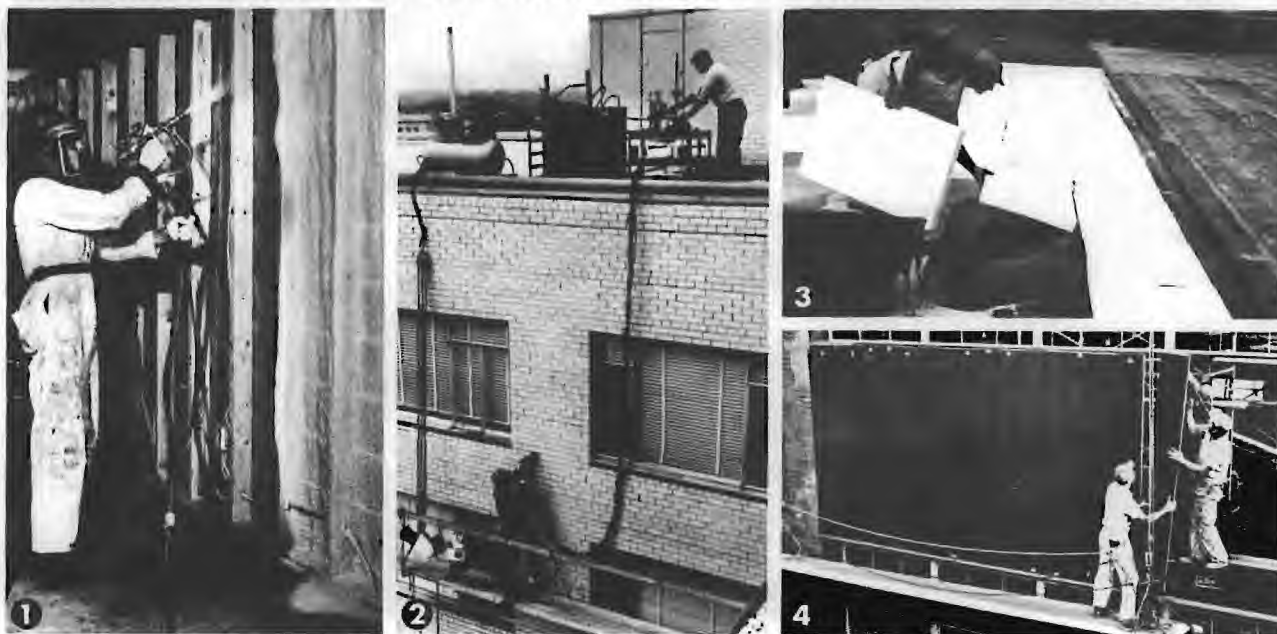
## LABORATORY DEMONSTRATION OF BASIC FOAM PRODUCTION PROCESS



These photographs illustrate the basic foaming process. (1) The two liquid chemical components are combined, (2) agitated for thorough blending, (3) poured into a receptacle where the foaming reaction begins immediately,

and (4, 5) expansion continues until (6) the rise is completed. Foam is tack-free shortly after completion of the rise. The rigid foam is 30 times the volume of the original chemicals leading to savings in shipping, handling costs.

## RIGID URETHANE FOAM PROVIDES WIDE CHOICE OF INSTALLATION METHODS TO SATISFY INSULATION REQUIREMENTS IN OLD AND NEW CONSTRUCTION



Urethane foam can be applied by a method best-suited to the individual job requirements: (1) Spray technique seals area between wall studs in new construction, (2) A foam-in-place method is used to insulate closed wall cavity in

major renovation project, (3) Slab boardstock is used to insulate roof and (4) Panels with core of lightweight rigid urethane foam which provides rigidity and insulation are fast way to enclose buildings.

Rigid urethane insulation can be foamed-in-place at the building site wherever insulation is required. Or it can be factory-produced and delivered to the job site for installation as slab boardstock, insulated building panels, doors, siding and other products.

### FOAM-IN-PLACE

Urethane foam can be produced at the building site by pouring, spraying or frothing the liquid components. These foam-in-place techniques are useful in insulating walls, roofs and other elements in new construction or hard-to-reach areas in existing buildings. Because urethane foam is produced from liquid components occupying 1/30 the volume of the expanded material, substantial savings in shipping, inventory and material handling costs are realized.

**Pouring:** This is an excellent method for installing a strong, seamless core of rigid urethane in wall cavities and on roofs. The foam fills all angles and corners of any space or cavity, going under pipes and wiring, around corners and into crevices.

**Frothing:** In this technique, the urethane chemicals are dispensed in a partially expanded state. Because the froth expands only about three times in the cavity rather than 30 times, this process often reduces pressure on mold or cavity walls.

**Spraying:** Large open surfaces such as walls or roofs can be covered with sprayed-on layers of rigid urethane, using special gun-type apparatus. The chemical components are mixed and atomized as they are sprayed. To attain the desired thick-

ness, thin layers are sprayed on successively, each adhering to the surface below, hardening, curing and sealing rapidly. The urethane foam surface may remain exposed, but normally it is covered.

### MANUFACTURED URETHANE INSULATION

**Boardstock or slabstock:** This rigid urethane foam is produced at a factory where it is cut into flat sheets of different thicknesses (generally  $\frac{3}{4}$ " to 6") and standard sizes. For many uses it is delivered and installed uncoated. For others, protective coatings, mastics, paints or structural or decorative skins may be applied in the manufacturing process.

Boardstock is used to insulate masonry, cavity walls, perimeters, slabs, foundations, basements and roofs. It is often applied with mastics or other adhesives, in some cases with nails or similar fasteners. No special equipment is needed.

**Building panels:** Lightweight sandwich panels that are strong and rigid are produced by injecting urethane chemicals between skins of aluminum, steel, glass fiber, plastic or plywood where the foaming reaction occurs. Urethane foam adheres readily; therefore, no adhesives, sealants or connecting devices are required.

Rigid urethane foam's good structural strength makes possible the use of lighter gauge skins with no loss in strength. The light weight of rigid urethane foam also helps to make it an ideal core material for stressed sandwich panels, curtain walls and other structural members. The lightweight panels can be installed quickly.

## MOISTURE RESISTANCE, LONG LIFE, STRUCTURAL RIGIDITY ARE PART OF URETHANE INSULATION PACKAGE

In addition to its unequalled thermal resistance, rigid urethane foam boasts many other properties essential in building construction.

**Minimum Water Absorption:** The stable, strong, cellular structure of rigid urethane foam locks out water penetration, the traditional bugaboo of building insulation.

**Fire Retardance:** Self-extinguishing urethane foams are readily available. Urethane foams with various degrees of fire retardancy to meet code and insurance specifications for many types of buildings are also available.

**Long Life:** Urethane foam is inherently tough, does not crumble, pack down or absorb moisture. It is these properties—so important for building insulation—that have made urethane the preferred insulation material in the refrigeration and transportation industries.

Many urethane foam installations have been in service for more than 12 years with no disintegration or other failure. Accelerated laboratory tests confirm that carefree service will continue.

**High Dimensional Stability:** Even under a wide range of temperatures (225°F to -300°F) and humidity, rigid urethane foam does not shrink or expand to form voids or dead spots which would reduce insulating efficiency.

**Low Water Vapor Permeability:** Rigid urethane foam has a moisture-passing rating in the range of one to four perm-inches, depending on density and formulation. This is frequently a sufficient moisture vapor barrier.

**Self-Adhering:** Foamed-in-place urethane adheres permanently and securely to virtually all building surfaces as it foams. Standard adhesives can be used to hold urethane boardstock material firmly in position.

**Structural Strength:** Rigid urethane foam has outstanding strength for its weight, increasing the strength of walls and other structural sections by as much as 100%. In a 1.5 to 2 pounds per cubic foot density, urethane has a compressive strength of 20-60 pounds per square foot. Its flexural and shear strength properties are excellent, making it possible to use thinner and lighter metal skins in urethane-core building panels with no loss in strength.

COMPARATIVE STRENGTH OF INSULATION MATERIALS

Insulation	Density (lb./cu. ft.)	Strength		
		Com- pressive	Flexural	Shear
Rigid Urethane Foam	2	35	45	25
Polystyrene Foam	2	35	45	30
Cork	6	10	26	—
Glass Fiber Board	6	3	80	—
Western Pine	25	5,000	9,000	1,100

## MORE EFFICIENT BUILDING METHODS AID ARCHITECTS, ENGINEERS, OWNERS

In computing the cost of urethane foam, the following factors should be considered:

1. In certain types of construction, rigid urethane foam can eliminate furring, lathing and vapor barriers.

2. Urethane's light weight can reduce load-bearing structural requirements in a building with corresponding cost savings.

3. Because it is more efficient than other insulating materials, urethane foam can be used in thinner sections reducing shipping, storage and handling costs. And when shipped to the job site as a liquid, urethane occupies only 1/30 the space of block-type materials to significantly reduce the per-foot cost of urethane foam insulation.

4. Thinner exterior walls make possible more useable and/or more rentable space.

5. The better insulation provided by rigid urethane foam lowers heating and cooling costs.

## CASE HISTORY REPORTS SHOW HOW TO REDUCE HIGH BUILDING COSTS

1. Sprayed urethane wall insulation in apartment building in Virginia eliminated furring and rock lath, cut installation costs by 35%. (Heating, cooling costs expected to be 10% lower per year, too.)

2. Urethane boardstock in New York State school cut dead load of roof by 300,000 pounds to reduce structural requirements as well as shipping, material handling, labor costs.

3. By eliminating furring, other steps, urethane foam insulation for exterior block walls and precast concrete ceiling saved Pennsylvania builder up to \$100/1000 square feet of wall area.

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## MOBAY CHEMICAL COMPANY

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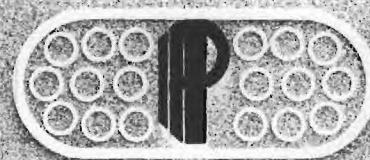
692 E. Market Street  
Akron, Ohio 44304

## PITTSBURGH, PA. 15205

3300 W. Peterson Avenue  
Chicago, Ill. 60645

6055 E. Washington Blvd.  
Los Angeles, Calif. 90022





## ISOFOAM<sup>®</sup> SS 24-44

Self Extinguishing Urethane Foam for Spray Application

### GENERAL

ISOFOAM SS 24-44 is a urethane chemical foam system specially formulated for application by airless spray. It combines excellent insulating properties with its ability to not support combustion. The low density foam produced has excellent load bearing characteristics.

ISOFOAM SS 24-44 is a two-component system and is sprayed in a 1:1 ratio. Application by spray is easy, fast (1200 sq. ft. of 1/4" insulation in 30 minutes per operator is normal), and efficient.

### APPLICATIONS

- Insulating the outside of tanks.
- Insulating process equipment.
- Insulating walls, ceilings, and floors of:
  - buildings
  - cold storage rooms
  - freezing rooms
  - railroad cars
  - trucks and trailers
  - mobile homes
- Controlling condensation on metal surfaces in humid conditions.

### ADVANTAGES

- Self-extinguishing—will not support combustion
- Superior insulating power—thinner walls needed
- Forms excellent bond with clean surfaces
- Forms a rigid monolithic insulating panel—doesn't settle
- Easily and quickly applied—saves time and labor
- Has good chemical resistance
- Has outstanding load bearing property
- Has excellent dimensional stability

## TYPICAL PHYSICAL PROPERTIES

### SS 24-44

Part A, Viscosity @ 70°F. 400 cps  
Part B, Viscosity @ 70°F. 250 cps

### FOAM

The following physical properties were obtained on samples produced by commercially available airless spray equipment.

### MECHANICAL

Nominal Density, lb. per cu. ft.	2
Compressive yield strength (ASTM C-165-54)	
Parallel to foam rise, psi	34.3
Perpendicular to foam rise, psi	13.8
Closed cell content	>90%
Aged "K" factor	
BTU/hr./sq.ft./°F./in.	0.15
Water Absorption (MIL-P-21929A), lb./sq.ft.	0.07

### AGING CHARACTERISTICS

200°F. for 3 days, % volume change	+8.0
-20°F. for 3 days, % volume change	<1
140°F. at 90% humidity for 7 days	
% volume change	+7.3

### FLAMMABILITY

ASTM 1692-67T	S.E.
	<1 inch <60 sec.



APPENDIX C  
SECOND TECHNOLOGY TRANSFER  
URETHANE FOAM INSULATION  
(Third Quarter Results)

<u>Type of Transfer</u>	<u>Group</u>	<u>Personal</u>	<u>Written</u>
Number of companies	8	4	8
Number attending	4	-	-
 <u>Action Taken</u>			
Process implemented	0	0	0
Process anticipated	0	0	0
Process being evaluated	2	1	3
No action to be taken	6	3	5

**ENGINEERING EXPERIMENT STATION  
GEORGIA INSTITUTE OF TECHNOLOGY**

☐ Visit at E.E.S.    ☐ Visit at Firm or Agency    ☐ Telephone Conversation

With Cullip Industries, Champion Home Builders, Inc., Marlette Coach (Telephone)

Firm or Agency \_\_\_\_\_

Address \_\_\_\_\_

Telephone No. \_\_\_\_\_ Date 12-19-68 Hour \_\_\_\_\_

By W. T. Studstill Project or Unit Follow-up Visits - Foam Technology Transfers

Cullip - Mr. Cullip says he has no immediate plans to include the foam technology in his operations. He says the foam appears too costly and hard to control. I questioned him on the type of insulation he would use in his new plant in Americus and he said it would probably be a different type than glass fiber, but he would not tell me exactly what it would be.

Champion Home Builders - Mr. Les Shewmake gave me pretty much the same story as Cecil Cullip - that is, he does not plan to use it in his plant because it takes too long to apply and it would be difficult to control.

Also, related to the gang-nail demonstration, the corporation officials have decided not to use a gang-nail truss system but to stay with their conventional method of fabricating these trusses.

Marlette - Made follow-up phone call to Tom Holman with Marlette. Tom says that he doesn't see any application for the foam technology in his operation in the near future. He says it appears to take too long to apply. I also relayed to Mr. Holman Mr. R. E. Moser's offer to spray a coach for field testing at only the cost of the chemicals. Tom politely refused saying that he had so much activity in his plant that it would not be convenient for him at this time.

**RIGID**

Panels made with URECOMB stay flat, rigid and dimensionally stable—there is no warping, buckling, deflection or distortion of any kind. Outer surfaces of the composite URECOMB core provide a continuous bonding surface for the application of wood, metal, asbestos, plastic, or whatever facing material suits the designer's taste.

**VERSATILE**

The extremely desirable combination of strength, light weight, insulation, and economy makes URECOMB the ideal core for a variety of structural applications. It serves with satisfaction in the broad areas of general insulation, refrigeration and even packaging. URECOMB's most common uses are in the fields of construction (industrial, residential, shelters, mobilehomes and travel trailers) and transportation (marine, automotive, rail and aircraft). In short, URECOMB is applicable in any situation that requires prefabricated panels which are light in weight, efficient in insulation and have high structural strength.

**FIRE RETARDANT**

The urethane foam used in URECOMB is self-extinguishing—an extremely important property in most applications. In addition, the cellular structure of the honeycomb sets up an unbroken series of fire stops within the panel. Thus URECOMB has no flue lines parallel to the facings which might support flame spread. Although URECOMB can be made with a special grade of fire-resistant honeycomb, regular grades are suitable for most applications.

**SIZE LIMITATIONS**

Maximum width	of Urecomb sheets	48"	**Maximum foam thickness	2½"
Minimum width		40	Minimum foam thickness	1
Maximum length	of Urecomb sheets	144"	Minimum cell size	¾"
Minimum length		34		
Maximum core thickness		4"		
Minimum core thickness		1		

\*Shorter sheets can be furnished at a slight upcharge.

\*\* There must be a minimum differential of ½" between foam thickness and core thickness.

**SOUND INSULATION**

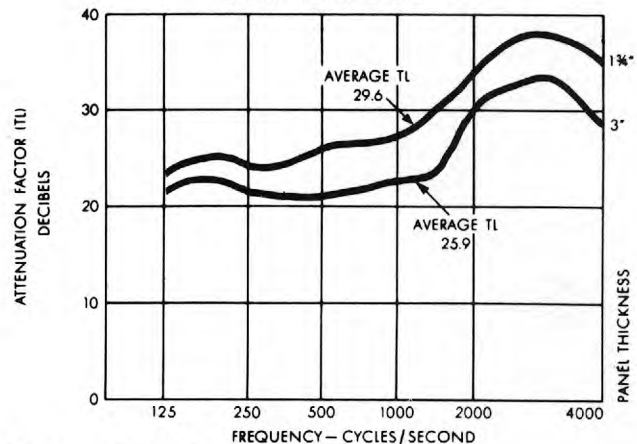
In addition to having a Sound Deadening effect on relatively thin facings, URECOMB panels also have substantial resistance to Sound Transmission. Fabricators of URECOMB panels report satisfactory transmission losses for most common installations.

**typical sound transmission****AVERAGE TRANSMISSION LOSS (TL)—Various Constructions**

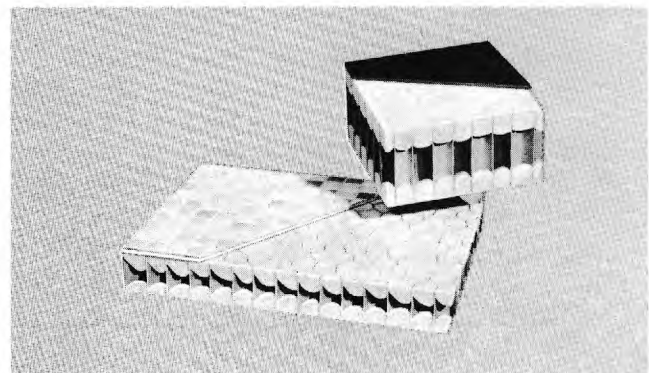
PANEL FACINGS Urecomb Core—1" cell	PANEL THICKNESS	
	1¾"	3"
Steel — 16 Gage	34.5	30.3
Steel — 20 Gage	29.6	25.9
Hardboard — ¼" Thick	25.4	24.6
Gypsum Board — ¾" Thick	26.6	25.9

**TYPICAL SOUND TRANSMISSION**

20 GAGE STEEL FACINGS — 1" CELL



Data Source: Gaiger &amp; Hamme

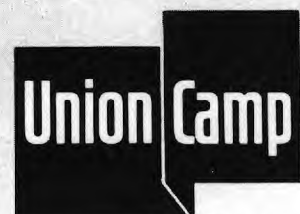


See our HONEYCOMB Catalog  
in Section 10c/Un of Sweet's Architectural File.

**HONEYCOMB DIVISION**

Union Camp Corporation

233 Broadway, New York, N.Y. 10007



## UPHOLSTERED FURNITURE INDUSTRY



## TECHNO-GRAM

**IES**INDUSTRIAL EXTENSION SERVICE  
SCHOOL OF ENGINEERING**NCSU**NORTH CAROLINA STATE UNIVERSITY  
RALEIGH, NORTH CAROLINA**OSTS**OFFICE OF STATE TECHNICAL SERVICES  
U. S. DEPARTMENT OF COMMERCE**SFMA**SOUTHERN FURNITURE MFG. ASSN.  
HIGH POINT, NORTH CAROLINA

JANUARY 22, 1979

MIRACLES. . .

. . . HAVE ABOUT GONE OUT OF STYLE NOW, AND NOBODY BELIEVES THEM IF THEY DO HAPPEN. EVEN THE TRIP TO THE MOON HAS A GOOD, LOGICAL STORY BEHIND IT, AND EVERYONE KNOWS ENOUGH ABOUT IT NOT TO BE OVERLY IMPRESSED.

SO NO ONE NEEDS TO GUSH LIKE A COPYWRITER OR CLAIM THAT TEFLON-S IS A MIRACLE MATERIAL WHICH WILL INSTANTLY MAKE ALL OUR TROUBLES DISAPPEAR. IT IS A REMARKABLE PLASTIC WITH MANY USEFUL PROPERTIES AND THE POTENTIAL ABILITY TO SOLVE A LOT OF OUR FACTORY PROBLEMS.

THE ENCLOSED INDUSTRIAL EXTENSION SERVICE BOOKLET TELLS ALL WE HAVE BEEN ABLE TO FIND ON TEFLON-S WITHOUT BECOMING OVERLY SCIENTIFIC, AND IT HAS A PARTICULAR EMPHASIS ON POSSIBLE USES IN UPHOLSTERED FURNITURE MANUFACTURING. INCLUDED IS SOME DU PONT MATERIAL WHICH GIVES A LOT OF NON-INDUSTRIAL BACKGROUND INFORMATION.

WE HOPE THESE THINGS WILL STIMULATE YOU TO SOLVE SOME OF YOUR PROBLEMS WITH THIS USEFUL NEW MATERIAL. PLEASE LET US KNOW WHEN YOU FIND OTHER SUCCESSFUL USES FOR TEFLON-S.

E. L. BRIGGS, JR.  
PROJECT DIRECTOR

-----CUT ON THIS LINE-----  
G-6

TO: INDUSTRIAL EXTENSION SERVICE  
School of Engineering  
North Carolina State University  
Box 5506  
Raleigh, N. C. 27607

ACTION  
REQUESTED

☐ Another problem that TEFLON-S might solve: \_\_\_\_\_

☐ We will try it on this problem and report to North Carolina State University.

☐ Please send me a free sample of TEFLON-S gummed foil when it is available.

☐ I do not receive the free IES Newsletter. Please add my name to the list.

Comments are appreciated.)

\_\_\_\_\_  
Name

\_\_\_\_\_  
Company

\_\_\_\_\_  
Address

# No tool carries this Seal unless the TEFLON finish has passed these 4 tests-regularly.



1. Microscopic inspection for film imperfections not visible to the naked eye.
2. Analysis for adequate coverage and proper bake.  
Tested by instruments and by skilled technicians.
3. Electronic measurements of film thickness.
4. Destructive tests for film adhesion.

No tool carries this seal unless TEFLON-S\* contributes to its performance. Manufacturers awarded the Quality Seal must *regularly* submit production samples to Du Pont for testing. Retail samples are also purchased and tested systematically. These tests insure continued compliance with high Du Pont standards. That's the only way we and you will be convinced that the Du Pont Certification Seal means what it says.

**Contact your normal tool supplier or Du Pont for further information about any and all of these TEFLON-S coated tools:**

Putty knives  
Wood planes  
Grass clippers  
Circular saw blades  
Anvil pruners  
Snow scrapers  
Snow shovels  
Crosscut saws  
Pruning saws  
Wall scrapers  
Taping knives  
Linoleum knives  
Drapery traverse rods

\*Trademark for Du Pont's stratified non-stick and self-lubricating finish.







INDUSTRIES, INC.

March 10, 1969

Mr. Richard Johnston  
Georgia Institute of Technology  
Industrial Development Division  
1132 W. Peachtree Street.  
Atlanta, Georgia 30309

Dear Mr. Johnston:

I am happy that we were able to Teflon coat and ship four of your blades plus the shaper on Friday March 7th via United Parcel Service. Your one remaining blade was mailed to you on Saturday. To explain the necessity of mailing, it was necessary that we re-coat this one blade.

For your information, I am listing below our prices for Teflon coating circular saw blades with an 8" diameter.

Lots of 50 or more	1.50 ea.
Lots of 20 to 49	2.70 ea.
Lots of 10 to 19	3.10 ea.
Lots of 1 to 9	3.50 ea.

An additional charge of 30¢ will apply per blade for every two inch increase in diameter.

We are confident of the good results which you will get with your demonstration to the group of manufacturers, and we do appreciate this opportunity to work with you and hope that you will allow us to serve you often.

Yours truly,

Roy H. Boggs  
Executive Vice President

rhb/n



## APPENDIX I

ENGINEERING EXPERIMENT STATION  
GEORGIA INSTITUTE OF TECHNOLOGY

☐ Visit at E.E.S.    ☒ Visit at Firm or Agency    ☐ Telephone Conversation

Company or Agency Cullip Industries, Inc

Address Ellaville, Georgia

Telephone No. \_\_\_\_\_

Date 3/21/69

Hour \_\_\_\_\_

Bill Studstill

Project or Unit Follow-up on Teflon-S Coated Blades

Listed below are the results of each of the saw blades coated for this test:

12-inch diameter carbide-tip blade -- This blade was installed on the gang-rip saw Thursday, March 13, 1969. I talked with Bradley Perkins, foreman, about the results. The blades are still in operation as are the other blades not coated on the gang-rip saw. Mr. Perkins says the teflon coated blade definitely operates better than the non-coated ones. At this time it is hard to say how much better. We should know this after another week's operation.

10-inch diameter carbide-tip blade -- This blade went on the table saw ~~XXXX~~ Wednesday, March 12, 1969. Bradley Perkins, foreman, says that it is still in operation and it appears to be operating better than the other blades which were not coated. Here again we need another week to evaluate the quantitative benefits to be derived from the blade.

10-inch diameter blade -- This blade was installed on a saw in the finishing department on March 17, 1969. It is still being used to cut wood mouldings. Mr. Ern Moser, foreman, says the blade is operating well and it will take more time to decide on how much better it is over the noncoated blades. He says it is definitely better however.

7 inch -Inch diameter blade -- This blade was supposed to be used in the plumbing department to cut plastic pipe and copper tubing; however, the teeth are too large to use in this department. This is no reflection on the teflon coating but a mistake in coating this type blade for the department. They are trying to find another place in the plant to test it.

6-inch diameter blade -- This blade was installed on a skill saw (hand saw) on Wednesday March 12, 1969. It is still in operation and working fine.

APPENDIX I Cont.

Mr. Johnston  
March 24, 1969

-2-

It is being used in the sidewall fabrication department to trim paneling. It will take more time to evaluate the results. However, the foreman feels it is definitely better than the noncoated blades.

Shaperhead--This sharperhead is not in use because the cabinet door on which it is used is not in production at this time. The foreman feels that if we want a good test of the shaperhead on cutting formica we should coat another head that is used on a cabinet door with higher production.

To summarize this follow-up visit, the consensus of opinion by the foreman is that the blades are better than the noncoated ones, but more time is needed to evaluate quantitatively the results to be obtained from the Teflon-S coating. I plan to make another follow-up visit at the end of this week.

BS:jh

**ENGINEERING EXPERIMENT STATION**  
**GEORGIA INSTITUTE OF TECHNOLOGY**

☐ Visit at E.E.S.    ☒ Visit at Firm or Agency    ☐ Telephone Conversation

h \_\_\_\_\_  
 m or Agency Cullip Industries  
 Address Ellaville, Georgia  
 ephone No. \_\_\_\_\_ Date 3-28-69 Hour \_\_\_\_\_  
 \_\_\_\_\_ Bill Studstill \_\_\_\_\_ Project or Unit Follow-up on Teflon-S Coated  
Blades 3-27-69

The following blades are still in operation and according to the foreman are performing very satisfactorily. The 12-inch diameter carbon tip blade which is on the gang-rip saw. The 10-inch diameter carbon tip blade on the table saw. The 6-inch diameter blade on the skill-saw. The normal operating days for the uncoated blades are as follows: Gang-rip, about two weeks; table saw, one week; skill-saw, about four days.

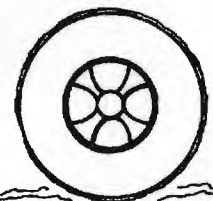
The only blade that did not give an appreciable amount of extra service was the 10-inch diameter blade that was installed in the finishing department. This blade came off the saw 3-24-69. It lasted five working days. The foreman says that an uncoated blade normally lasts from four to five working days.

I plan to make another follow-up visit the end of next week.

cc: Dick Johnston/MH file/Cullip file.



# TECHNOLOGY FROM TECH



INDUSTRIAL DEVELOPMENT DIVISION  
ENGINEERING EXPERIMENT STATION  
GEORGIA INSTITUTE OF TECHNOLOGY

1132 WEST PEACHTREE STREET, N.W., ATLANTA, GEORGIA 30309

Under a grant from the United States Department of Commerce, Office of State Technical Services, with matching funds from Georgia Tech, staff members of Tech's Industrial Development Division are working on a two-year project to transfer new technology to the mobile homes manufacturing industry.

HARRY L. STILTZ, PROJECT DIRECTOR

## OUR MESSAGE FOR TODAY

We have completed the first technology transfer, which was the use of the Gang-Nail System for manufacturing roof trusses. However, the primary purpose was to encourage automation throughout the entire plant. We have also completed the second technology transfer, which was the use of sprayed-in-place urethane foam insulation. We hope both of these technology transfers have created some innovative activities within each company.

We realize in this project that most manufacturers are reluctant to implement any changes at a time when demand for the product exceeds production capability. However, we urge that each technology transfer be thoroughly studied and retained for possible future usage.

Since we selected the first two technology transfers and are getting ready for a third within the next six or seven weeks, we would like for this one to be a technology dictated by the industry. Even though the industry is booming, we feel there must be areas in which you feel a need for improvement.

Will you please take a few minutes to fill out the attached questionnaire, and return it at your earliest convenience, in the enclosed addressed and stamped envelope. You may omit the name of your company if you wish. However, if you would like some technical assistance in a specific area, please indicate this at the end of the questionnaire and we will pass it along to our Technical Services Branch.

Thank you for your cooperation.



TECHNOLOGY TRANSFER QUESTIONNAIRE

JANUARY 31, 1969

Please circle the letter in front of the answer that most nearly matches the question. If you wish to comment on any question please do so on the reverse side of the page.

1. What is your opinion as to the value of Georgia Tech's mobile home technology transfer?
  - (a) No value
  - (b) Valuable because of creating innovative thinking.
  - (c) Valuable for possible future use to meet competition.
  - (d) Valuable for general knowledge.
2. Is "cost" your first consideration when deciding whether or not you will adopt a new technology?
  - (a) Yes
  - (b) No
3. Would you consider adopting a new technology if it would increase your costs but at the same time increase the quality of your mobile home in an area that could not be seen by the customer? (As an example, a superior roof insulation that would reduce the customers' heating and air conditioning bills)
  - (a) Yes
  - (b) No
4. Again on question #3, would you pay more for improved quality that can be seen by the customer? (For example, new counter tops that the dealer could demonstrate by hitting with a hammer, trying to scratch with a sharp object, and trying to burn by pouring lighter fluid on it and lighting it.) (We recently witnessed a demonstration like this.)
  - (a) Would not consider this if it cost more.
  - (b) Would consider this on the basis of how much more it cost.

Contd.

5. Are you presently able to sell as many units as you can produce?

(a) Yes  
(b) No

If your answer is "yes," does this influence your consideration of new technology? In other words, would you decide not to adopt a new production technique or a new material at the present time because you don't have to?

(a) Yes  
(b) No

6. If you are presently receiving "Technology from Tech" notes, would you like to have your name:

(a) deleted from the mailing list?  
(b) retained on the mailing list?

7. Do you think it would be possible to get a group of manufacturers to share the cost of a mould to make a one-piece roof? If Georgia Tech conducted a study that showed a one-piece plastic moulded roof was feasible and economical, would your company consider participating in a joint venture with other manufacturers?

Question #1 : (a) Yes (b) No

Question #2 : (a) Yes (b) No

8. Please list below any items you would like for Georgia Tech to consider as a technology transfer. These can be either tangible items (new materials, new manufacturing techniques, etc.) or intangible items (inventory control, labor relations, etc.).

5. Are you presently able to sell as many units as you can produce?

(a) Yes  
 X (b) No

If your answer is "yes," does this influence your consideration of new technology? In other words, would you decide not to adopt a new production technique or a new material at the present time because you don't have to?

(a) Yes  
 X (b) No

6. If you are presently receiving "Technology from Tech" notes, would you like to have your name:

(a) deleted from the mailing list?  
 (b) retained on the mailing list?

7. Do you think it would be possible to get a group of manufacturers to share the cost of a mould to make a one-piece roof? If Georgia Tech conducted a study that showed a one-piece plastic moulded roof was feasible and economical, would your company consider participating in a joint venture with other manufacturers?

Question #1: (Yes) X (b) No

Question #2: (Yes) X (b) No

8. Please list below any items you would like for Georgia Tech to consider as a technology transfer. These can be either tangible items (inventory control, labor relations, etc.).

- ✓ (1) Inventory Control
- ✓ (2) Hydraulic scaffolds (60 to 65' in length)
- ✓ (3) Better time & motion study techniques for laymen I.E.'s
- ✓ (4) New type wood & metal fastener

5. Are you presently able to sell as many units as you can produce?

(a) Yes  
(b) No

If your answer is "yes," does this influence your consideration of new technology? In other words, would you decide not to adopt a new production technique or a new material at the present time because you don't have to?

(a) Yes

(b) No

6. If you are presently receiving "Technology from Tech" notes, would you like to have your name:

(a) deleted from the mailing list?

(b) retained on the mailing list?

7. Do you think it would be possible to get a group of manufacturers to share the cost of a mould to make a one-piece roof? If Georgia Tech conducted a study that showed a one-piece plastic moulded roof was feasible and economical, would your company consider participating in a joint venture with other manufacturers?

Question #1: (Yes) (No)

Question #2: (Yes) (No)

8. Please list below any items you would like for Georgia Tech to consider as a technology transfer. These can be either tangible items (inventory control, labor relations, etc.).

*We would be more interested in tangible items. Any new building materials that would speed production decrease labor cost and material cost.*

*ARMOR Homes  
P.O. Box 487  
Ashburn, GA.*

# APPENDIX N

Technology Transfer Questionnaire

-2-

1/31/69

5. Are you presently able to sell as many units as you can produce?

(a) Yes

(b) No

If your answer is "yes", does this influence your consideration of new technology? In other words, would you decide not to adopt a new production technique or a new material at the present time because you don't have to?

(a) Yes

(b) No

6. If you are presently receiving "Technology from Tech" notes, would you like to have your name:

(a) deleted from the mailing list?

(b) retained on the mailing list?

7. Do you think it would be possible to get a group of manufacturer, to share the cost of a mould to make a one-piece roof? If Georgia Tech conducted a study that showed a one-piece plastic moulded roof was feasible and economical would your company consider participating in a joint venture with other manufacturers?

Question #1 : (a) Yes (b) No

Question #2 : (a) Yes (b) No

8. Please list below any items you would like for Georgia Tech to consider as a technology transfer. These can be either tangible items (new materials, new manufacturing techniques, etc.) or intangible items (inventory control, labor relations, etc.).

✓ 1. PREFINISHED FLOOR DECKING

✓ 2. SUBSTITUTES FOR STEEL ROOFS

✓ 3. VALUE ANALYSIS OF SIDEWALK BELT RAILS





ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE of TECHNOLOGY

Industrial Development Division

1132 W. Peachtree Street  
Atlanta, Georgia 30309  
873-2931 Area Code 404

April 1, 1969

Mr. Fred McKaig, President  
Cavalier Homes, Inc.  
P. O. Box 160  
Industrial Park  
Cordele, Georgia 31015

Dear Fred:

Enclosed is a self-explanatory letter from Prof. Joseph N. Smith of our School of Architecture regarding your question on the use of belt rails in mobile home construction. As you can see, they are a necessary structural member and not just a point of attachment for the siding as a few people have indicated.

Your other subjects of interest: (1) pre-finished floor decking and (2) substitute for steel roofs, are still under investigation.

We appreciate your interest in our project and your response to our questionnaire. I would also like to personally thank you for your cordial welcome during my most recent visit.

Sincerely,

Harry L. Stiltz  
Project Director

HLS/am  
Enclosure

**GEORGIA INSTITUTE OF TECHNOLOGY**  
**ATLANTA, GEORGIA 30332**

SCHOOL OF  
ARCHITECTURE

March 12, 1969

MEMORANDUM

To: Mr. Harry L. Stiltz

From: Mr. Joseph N. Smith

Subject: Sidewall Belt Rails for Mobile Homes

In as much as mobile homes are typically built without sheathing and the siding is not usually applied in a manner to act structurally, the belt rails are the only thing that braces the outer edge of the studs. Without the reduction in length thickness ratio offered by the rails the studs might fail by crippling. As it is, the notching of the stud undoubtedly increase the stress in the outer fiber of the stud over what it would be if not notched.

The strapping would appear to be desirable to lend rigidity. Once again, since the wall is not a stressed skin in which both faces participate, this is the only way to prevent racking at the outer face.

It is my opinion that to eliminate either of these would constitute a reduction in rigidity of the unit.

Joseph N. Smith  
Associate Professor and  
Administrative Assistant

JNS:cc

TRIP REPORT

COORDINATION MEETING WITH NORTH CAROLINA STATE

UNIVERSITY ON OST'S SPECIAL MERIT PROJECT

High Point, N. C. - January 23-24, 1969

by

Harry L. Stiltz  
Project Director

January 27, 1969

Mr. Frank Clarke and I visited Mr. Roy Briggs, Project Director, Special Merit Project, North Carolina State University, and Professor Rudolph Willard, Furniture Manufacturing and Management Faculty, North Carolina State University, at High Point, North Carolina, on January 23 and 24, 1969. The purpose of meeting at High Point rather than on the campus at Raleigh was to incorporate visits in that area as a part of our meeting.

Our first visit on January 23 was to the Winter Market of the Southern Furniture Exposition. We toured approximately ten floors of the Southern Furniture Exposition Building, observing many styles of furniture and discussing various aspects of the furniture industry with company representatives. This was an informative tour, and can be summarized by stating that the trend towards use of plastics in furniture manufacturing is just beginning. One representative showed us various items of furniture having tops (coffee tables, chests, etc.) of simulated slate. These tops were fabricated by covering particleboard with a thin sheet of fiber glass that simulated solid slate. The representative (who weighed about 200 pounds) jumped up and down on a coffee table, hit the top of the table several times with a hammer, attempted to scratch the surface with a sharp metallic object, and finally poured lighter fluid on the table top and set it on fire. At the conclusion of this abuse there was no visible damage to the table. Can you imagine a cocktail party where the host doesn't need tranquilizers because of dropped cigarettes and spilled drinks?

Another company is paying \$20,000 for a mould for end sections (arms, sides, and legs) for Spanish style chairs and sofas. Naturally, the end sections were designed to be interchangeable (left to right) so that only one mould is needed.

We also toured two upholstered furniture manufacturing plants (Kay Lyn, Inc. and Sedgfield Furniture Corp.) and were surprised at the lack of automation. The fabric pieces are cut by hand (using electric scissors) and are installed on frames by hand. Although pneumatic staplers are used in many areas, the installer with a mouth full of tacks and a magnetic tack hammer is still present. We were also surprised that many manufacturers purchase furniture frames from foreign countries.

Our last visit was to the Hatteras Yacht Company where we learned much about the process of fiber-glass "lay-up." We were under the impression prior to our visit that they used a considerable amount of urethane foam for buoyancy,

but found this to be untrue. Their yachts range from 31' to 53' in length, and urethane foam usage is restricted to filling hollow fiber-glass stringers (approx. 4" x 8") installed in the keel. These stringers are installed to provide additional strength and to serve as mounting areas for engines and other components.

It was amazing that employees laying alternate layers of fiber glass and resin inside the hull moulds did not wear respirators. We were on a high platform above the top of the mould and could barely stand the resin fumes effect in our eyes and nostrils.

During our rides from one visitation point to another and during our free time at the motel, we discussed our respective activities on the special merit project. The writer also showed movie films of the two technology transfer demonstrations accomplished by Georgia Tech.

Outside of the previously discussed dowel pin technology transfer, North Carolina State's transfers have been in intangible areas (management training, panel discussions of manufacturing techniques, etc.) and will be difficult to evaluate. The project director recognizes this and is studying various tangible technology areas such as moulded plastic and particleboard frame parts for future transfers.

Both project directors agreed that no meaningful evaluation of technology transfer effectiveness can be accomplished at this time. However, we can evaluate trends of interest in each company and cooperative attitudes of various management levels. This type of evaluation should be a guide to future technology selection.

We enjoyed all phases of the trip except closing of the airport on account of fog while we were preparing to land and the actual landing 45 minutes later under minimum conditions.

HLSam

From SEMHI Newsletter, January 1969, Published by the Southeastern Mobile Housing Institute, Inc.

## Technology From Tech

*Under a grant from the United States Department of Commerce, Office of State Technical Services, with matching funds from Georgia Tech, staff members of Tech's Industrial Development Division are working on a two-year project to transfer new technology to the mobile homes manufacturing industry.*

### **AUTOMATION—A KEY TO CONSISTENT QUALITY AND PREDICTABLE PRICING**

At a demonstration in Americus, Georgia, on October 22, 1968, a Bowstring Multihead Press was used to automatically assemble mobile home roof trusses. The purpose was to demonstrate the ease with which automation can be incorporated into mobile home production.

An 8 mm movie film of this demonstration is available at SEMHI headquarters and information regarding the equipment used can be obtained from Automated Building Components, Inc., 7525 N. W. 37th Avenue, Miami, Florida 33147. Other firms having similar equipment are invited to send information on their equipment to SEMHI.

Georgia Tech regrets that all mobile home manufacturers in the Southeast can not be invited to all technology transfer demonstrations. However, we do not have ample facilities, so we propose to keep you informed by making technical data and movie films available through SEMHI.





ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE of TECHNOLOGY

Industrial Development Division

1132 W. Peachtree Street  
Atlanta, Georgia 30309  
873-2931 Area Code 404

February 10, 1969

Mr. L. J. Ballantyne  
Manager, Mobile Homes Division  
Automated Building Components, Inc.  
7525 N.W. 37th. Ave., Drawer J  
Miami, Florida 33147

Dear Lou:

I received your message regarding the request from Mr. Jack Carlisle, President, Empire Management Corporation to review our movie film on the Gang-Nail Bowstring Roof Truss demonstration.

I am forwarding the film to the project director, Mr. E. L. Briggs, Jr., at North Carolina State University, and by copy of this letter, requesting that he have his associate, Mr. Ben Travis, deliver the film to Mr. Carlisle. I am listing Mr. Carlisle's address here for Ben's information:

Mr. Jack Carlisle, President  
Empire Management Corporation  
607 W. South St.  
Raleigh, North Carolina 27603

Incidentally, I have not received the engineering data on the 1200 F Hemlock and Construction Grade Spruce truss load tests. Is that data available?

Sincerely,

Harry L. Stiltz  
Project Director

HLSam  
CC: Mr. E. L. Briggs, Jr.,  
North Carolina State University



ENGINEERING EXPERIMENT STATION

## GEORGIA INSTITUTE of TECHNOLOGY

Industrial Development Division

1132 W. Peachtree Street  
Atlanta, Georgia 30309  
873-2831 Area Code 404

March 17, 1969

Mr. William T. Orton  
Nebraska State Technical Services  
University of Nebraska  
Lincoln, Nebraska 68508

Dear Mr. Orton:

As a follow up to your previous correspondence with our Mr. R. L. Yobs, we are forwarding the enclosed "Technology from Tech" releases covering our first two technology transfers to the mobile home industry.

Our findings thus far have indicated that a rapidly growing industry of this type, where supply still lags behind demand, is reluctant to consider any innovation unless it offers an immediate cost reduction and can be incorporated without any modification or slow-down of existing production lines. However, our continuing evaluation may prove that this industry is innovative but on a much longer term basis than we had anticipated.

We are in the process of making our third technology transfer but do not have written material available at this time. This transfer will involve coating saw blades and small tools with Du Pont's new nonwetting, low-friction Teflon-S. We will forward literature on this transfer later.

Thank you for your interest in our activities.

Sincerely,

Harry L. Stiltz  
Project Director

HLSam  
Enc:



ENGINEERING EXPERIMENT STATION

## GEORGIA INSTITUTE of TECHNOLOGY

Industrial Development Division

1132 W. Peachtree Street  
Atlanta, Georgia 30309  
873-2931 Area Code 404

March 12, 1969

Mr. Roger H. Mattson  
Field Services Representative  
Utah Industrial Services Agency  
118 Steward School  
The University of Utah  
Salt Lake City, Utah 84112

Dear Mr. Mattson:

The enclosed data are in response to your recent correspondence with our Mr. R. L. Yobs.

At the present time, we have completed two technology transfers to the mobile home industry and are planning a third in the near future. Enclosed are data from the first two transfers. The third transfer will be the application of Du Pont's new Teflon-S to saw blades, routers, drill bits and small tools.

An advertisement concerning the use of Teflon-S appeared in Design News, Product Engineering, Machine Design, and Materials Engineering in December 1968. The advertisement reported results of tests on rip saw blades that extended their required cleaning cycle from one time per shift to one time per 36 shifts (and longer). We feel that this technology will be of considerable interest to the mobile home manufacturers.

Your request for information on mobile home manufacturers who produce mobile offices is a difficult one. A Georgia manufacturer who used to supply these has recently discontinued manufacture of special units due to the lower profit level as compared to the standard mobile home. In fact, we have unsuccessfully tried for the past week to get a Georgia manufacturer to supply a mobile office unit to the Atlanta Housing Authority. The mobile home manufacturers in Georgia have increased over 25% since our project started in July 1968, but they are still not able to keep up with the demand. Therefore, no one is interested in changing their production line to produce special units.

We appreciate your interest in our activities. If you need additional information please let us know.

Sincerely,

Harry L. Stiltz  
Project Director  
Special Merit Project

HLSam  
Enc:

QUARTERLY REPORT NO. 4  
(April 1, 1969 through June 30, 1969)

A DEMONSTRATION OF THE APPLICATION OF  
TECHNOLOGY TRANSFER TECHNIQUES TO TWO  
CONTRASTING REGIONAL INDUSTRIES

Prepared for  
OFFICE OF STATE TECHNICAL SERVICES  
UNITED STATES DEPARTMENT OF COMMERCE

by  
Harry L. Stiltz  
Project Director

A joint project with the  
Industrial Extension Service  
School of Engineering  
North Carolina State University

Industrial Development Division  
Engineering Experiment Station  
GEORGIA INSTITUTE OF TECHNOLOGY  
June 30, 1969

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## BACKGROUND

In June 1968, the Office of State Technical Services, U. S. Department of Commerce, awarded grants totaling \$123,431, to be matched equally by state funds, to the Industrial Development Division (IDD) of the Georgia Institute of Technology and the Industrial Extension Service (IES) of North Carolina State University for a two-year joint Special Merit Project, effective July 1, 1968. The purpose of the program is to demonstrate the application of technology transfer techniques to two contrasting regional industries. In North Carolina, the upholstered furniture industry, a traditional industry with a reputation for being relatively slow to take advantage of technological change, was selected. In Georgia, the mobile home industry, an emerging industry generally considered to be technically advanced and receptive to innovation, was chosen.

### Objectives

The overall objectives of the joint program are to identify the most effective methods of technology transfer and to determine whether they differ for traditional and emerging types of industry.

Objectives of the Georgia Tech segment of the program (OSTS Grant No. 1310-001) are as follows:

1. To identify new technology appropriate to the mobile home industry within the State of Georgia, and to effectuate the transfer of that technology by various techniques.
2. To evaluate the relative effectiveness of the various techniques of technology transfer.

### Plan of Procedure

The first month of project activity in 1968 was devoted to preparation of a Plan of Procedure which was included in Quarterly Report No. 1 (July 1, 1968, to October 1, 1968). The plan set forth a detailed schedule of activity for the first year of the project and was divided into three phases.

Phase I - Initial Planning and Technology Search. Phase I was completed on schedule during the first quarter and is fully covered in Quarterly Report No. 1

Phase II - First and Second Technology Transfer. Phase II was scheduled for completion during the third quarter and was partially reported in Quarterly Report No. 2 (October 1, 1968, to January 1, 1969). Except for extension of time for technology transfer effectiveness study, Phase II was completed on schedule and is reported herein.

Phase III - Third Technology Transfer and Project Evaluation. The third technology transfer scheduled for the third quarter was completed, but additional time will be spent evaluating this transfer during the fifth quarter.

#### Summary of First Quarter Activities

The first quarter was devoted to procedure planning, publicity releases, coordination with North Carolina State University, coordination with Industrial Development Division (IDD) field personnel, visits to mobile home manufacturing plants in Georgia, participation in the Southeastern Mobile Housing Institute (SEMHI) Convention, attendance at the Man and His Shelter Conference at the National Bureau of Standards, selecting contact companies, gathering and studying literature on new technology, and preparation for the first technology transfer.

#### Summary of Second Quarter Activities

The second quarter was devoted to the first technology transfer (use of the gang-nail system of roof truss fabrication), evaluation of transfer effectiveness of the first transfer, and selection and transfer of the second technology (urethane foam insulation). A report on transfer effectiveness of the second transfer is included herein.

#### Summary of Third Quarter Activities

The third quarter was devoted to the third technology transfer (Teflon-S for saw blades, shapers, drill bits, etc.); evaluation of transfer effectiveness for this technology, and preparation of a new Project Plan (schedule) for the second year of the project.

## FOURTH QUARTER ACTIVITIES

### Phase II

A copy of the "Technology from Tech" data used for the second technology transfer, the use of sprayed-in-place urethane foam insulation, was included in Quarterly Report No. 2. At the end of the second quarter, this transfer had been completed, but no results had been obtained.

The remainder of Phase II, scheduled for completion during the third quarter, included evaluation of the effectiveness of the second technology transfer, continuation of new technology search, and a coordination meeting at North Carolina State University. All work was completed on schedule for this phase of the project.

### Phase III

As a result of studies conducted by the North Carolina State University project director and a subsequent technology transfer, the project staff became aware of Du Pont's new Teflon-S low friction nonwetting finish. It was decided to involve the mobile home industry in testing Teflon-S by obtaining five saw blades and a shaperhead from one mobile home manufacturer and having them coated with Teflon-S. These coated blades were tested by this mobile home manufacturer, and an evaluation of the results indicated that the Teflon-S coated blades would require sharpening much less often than they did prior to being coated.

Since the actual method of coating the blades with Teflon-S has no particular bearing on the technology transfer process and since there was no way of having a group demonstration due to the length of time required for evaluation, it was decided that the group demonstration would be the written material that described in detail the results of the tests performed by Cullip Industries, Inc., Ellaville, Georgia. This information would show results of a new technology used by a Georgia mobile home manufacturer. This information would not be given to the companies receiving the technology by direct personal transfer or by written transfer. The information going to these companies would contain only the information supplied by Du Pont. The purpose of this approach was to see if the companies would accept technology from another industry without knowing that



it had been tried, with outstanding results, in the mobile home industry.

#### Results of First Technology Transfer

As stated in Quarterly Report No. 2, the mobile home industry has been found to be a rapidly growing, highly profitable industry that will not respond to technological changes rapidly. Supply has not kept pace with demand, so the industry is more concerned with increasing production than in introducing new technology.

It was also noted that a rapidly growing industry is normally confronted with a shortage of management personnel that further restricts ability of the industry to keep pace with customer demand for its products. This has been especially true in the mobile home industry and has resulted in forced use of inexperienced personnel who have to devote most of their time to learning existing manufacturing techniques. Therefore, in most instances, they are reluctant to make changes until they are firmly established in their management positions.

It was decided, then, to extend the evaluation periods beyond the originally scheduled six weeks before making preliminary evaluation of transfer effectiveness for each technology. This change in procedure has enabled the project staff to reach conclusions regarding the first technology transfer (gang-nails) that were not apparent at the end of the second quarter. At that time, no company had adopted use of the gang-nail system of roof truss fabrication, and no company had adopted use of gang-nails in other applicable areas (such as floor stringer splicing, wall-to-wall ties, and wall-to-floor ties) as a result of the technology transfer. However, that situation changed considerably during the third quarter.

As of June 1969, North Carolina State University reports that three of their 13 mobile home contact companies are now using gang-nails and a fourth company is in the process of ordering two gang-nail roof truss systems. Transfer to these companies was made by direct mail, and information on action taken was obtained by personal visits. It will be interesting to see if the personal visits will encourage implementation of gang-nail usage by the other companies.

Four mobile home manufacturers in Georgia adopted the use of gang-nails during the third quarter and another is preparing to set up a separate plant to supply gang-nail roof trusses to its several mobile home plants. The first four were newly formed companies to whom transfer had been made by direct mail and followed up by subsequent visits.

None of the four manufacturers who attended the first technology group presentation has adopted use of this technology. Also, neither of the two manufacturers to whom a personal transfer was made has adopted it. Summarizing the evaluation of the first technology transfer, the following facts are pertinent:

1. None of the 29 contact companies (in Georgia and North Carolina) had adopted this technology at the end of the second quarter (approximately six weeks after completion of the transfer).

2. Nine companies adopted the technology during the third quarter.

3. All nine of the receptive companies were originally contacted by "written" transfer.

4. Five of the nine adopted the technology after follow-up personal visits, whereas the other four received only the written material.

5. No additional companies adopted the technology during the fourth quarter.

At this point, it can be tentatively concluded that the most effective method of transfer for the first technology was the "written" transfer. However, the "direct personal" transfer cannot be ruled out since (1) five of these companies adopted the technology after the first follow-up visit (it shall subsequently be determined if the personal visits influenced these companies) and (2) the number of sample companies selected for the "direct personal" transfer was too small (this number was increased considerably for the second technology transfer).

#### Results of Second Technology Transfer

The second technology transfer was completed during the second quarter and results have been continuously monitored during the third quarter. The original "Technology from Tech" data that were used for this technology (urethane foam



insulation) were included in Quarterly Report No. 2.

An analysis of the effectiveness of this transfer resulted in a modification of the original plans for the selection of a third technology. Most manufacturers were impressed with the use of urethane foam as an insulating material, but felt that the process of application was too sophisticated to be incorporated into their production facilities. It was decided, therefore, that a simple technology should be selected for the third transfer in order to obtain at least partial acceptance. Otherwise, it would not be possible to attain one of the major objectives of the project (determination of the best method for transferring technology).

Appendix C in Quarterly Report No. 3 shows that 14 of the 20 companies receiving the transfer in Georgia have definitely decided not to implement the urethane foam insulation process. However, the North Carolina State University project director reported that requests for a demonstration of this process in North Carolina were so numerous that he has arranged one for his mobile home contact companies. The same firms (Isocyanate Products, Inc., and Binks Manufacturing Company) that conducted the demonstration in Georgia have agreed to conduct another in North Carolina.

The project director proposes to continue supplying data on urethane foam to the contact companies from time to time through "Technology from Tech" releases. Although the mobile home industry, per se, may never adopt this technology, it is quite possible that those manufacturers who propose to enter the modular (low-cost) home industry may find it to be a useful technology. The modular homes must be approved by FHA, whereas mobile homes do not since the FHA will not insure mortgages on mobile homes. A few Georgia mobile home manufacturers presently are making plans to produce modular homes; as they progress in their planning, they will find that many materials and construction techniques currently utilized in mobile home manufacturing will no longer be acceptable. The presently used thin fiber-glass insulation that does not contain a vapor barrier will not be acceptable. Neither will FHA accept the present method of installing this fiber glass. Therefore, a more expensive fiber-glass batt (thicker, and including a vapor barrier) that must be completely stapled to wall studs from top to bottom will be required (in most mobile homes the fiber glass is not fastened at all and consequently slides down from the top of the wall during transit).

Some of the objections to using urethane foam insulation included the possibility of increased costs. The project director computed costs of using this process versus using fiber glass and found that the cost would be increased approximately \$50.00 for a 12' x 60' mobile home. This is not an appreciable cost, since the mobile home owner would undoubtedly save that much in fuel expenses within the first year. However, to the average manufacturer who produces about 2,000 mobile homes per year, it represents a considerable increase in cost. If the manufacturer could successfully convince the dealer and the dealer could successfully convince the customer, and if the increased cost were absorbed by the customer, everyone would benefit. The computed cost comparison data were not distributed to the manufacturers because Georgia Tech cannot put itself in the position of comparing costs on one company's product with another.

However, the manufacturer should be able to make this comparison without difficulty since cost data on urethane foam were provided to those who requested it.

Another objection to using urethane foam insulation was that it would take too long to apply. This objection is partially valid since some provision (like enclosing the mobile home with a curtain wall) would have to be made because of "over-spray" affecting adjacent areas. However, the project director conducted a time-and-motion study at one plant and found that it takes about the same time to apply the foam as to install fiber glass. .

Although the urethane foam technology appears to be unacceptable to the mobile home industry, study of this technology has produced valuable information for use in the Housing Resources Center at Georgia Tech. This center has already received a valuable input from Union Camp Corporation and is presently working with this corporation and an architectural firm on the use of Urecomb panels in factory manufactured housing.

#### Results of Third Technology Transfer

The third technology transfer (Teflon-S coating for cutting tools) was completed during the fourth quarter and results have been continuously monitored during this quarter. The data transferred to the contact companies are included in Appendix A, which is the information presented to the group transfer contact companies, and in Appendix B, which is the information presented to the direct

personal transfer companies and the written transfer companies.

At the end of the fourth quarter, follow-up reports from three to twenty contact companies had not been received. Ten of the fifteen contact companies have either adopted the technology or have indicated they plan to adopt it after evaluating their local tests. Of the remaining seven companies, four had forwarded the information to their headquarters for evaluation and possible authorization for local implementation. Officials of the three companies who had lost or misplaced the Teflon-S information promised to study new copies of the Teflon-S information and consider adopting the new technology. Additional follow-up visits in the fifth quarter will be made to determine their action. Appendix C shows a detailed analysis of replies and comments by the contact companies to the Teflon-S technology transfer. The Teflon-S technology acquired through activities of this project is now being used by two non-contact companies.

The North Carolina State University project director reported that there has been no feedback to them from the Teflon-S technology transfers.

#### Coordination with North Carolina State University

A project coordination meeting was held at Georgia Tech on May 8-9, 1969. Included was a tour of two automobile assembly plants on May 9.

Mr. E. L. Briggs, Jr., of North Carolina State University, and Mr. R. L. Yobs, Mr. H. L. Stiltz, and Mr. Richard Johnston of Georgia Tech toured the plants of General Motors at Doraville, Georgia, and Ford Motor Company at Hapeville, Georgia. The objective of the tour was to observe their operations and to obtain ideas on automation that could be used in assembling mobile homes and manufacturing furniture.

Both of these plants have highly automated assembly operations with fantastic inventory and materials flow problems whose solution requires the coordinated use of a variety of materials handling equipment and special tools. Some of these relatively simple tools that could have application to the mobile home manufacturing industry are:

1. Tru-Tork vibrator feeder for small parts such as screws for fastening aluminum panels to outside walls.



2. Vacuum cups for handling items such as large sheets of aluminum and glass.
3. Multiple head lug machine for attaching wheel lug nuts to wheel bolts.
4. Various methods of pre-positioning and storage of electric and pneumatic tools.
5. Special tools for hard-to-handle items such as front and rear seats.

## CONCLUSION

### Tentative Evaluation of the Transfer Process

An evaluation of the third technology transfer (Teflon-S) has substantiated the earlier conclusion that it would be most difficult to transfer progressively complex technologies to this industry due to the low level of technical competence in most plants. Even with this simple technology transfer, it was necessary to supply much additional assistance, such as where to get the blades coated, how to get them coated and sharpened without being out of the plants over a few days, and what will it cost.

One of the primary objectives of the project is to evaluate the relative effectiveness of the various techniques of technology transfer. To do this for each of the three technology transfers, an analysis of the action taken in response to each transfer by each company was made by listing the various replies, which were then classified as being a positive or negative response. (See Appendix D.)

It is to be noted that for all types of transfers only the direct personal transfer consistently had a majority of positive responses. At this half-way point in the project, it definitely appears that the most likely method to get a positive response to a technology transfer is by a direct personal approach by an impartial, technically qualified person.

Other conclusions to draw from the responses are:

1. Branch plants are often without local authority and cannot adopt even the simplest technological innovations until the parent headquarters receives, evaluates, and authorizes the technology to be used in branch plants.
2. New technology information is not always circulated to higher management because the information is lost, filed, taken with resigned employees, or just disappears, and it most often occurs from the written transfer technique.

### Second Year Plans

At the end of the fourth quarter and first year, the original schedule is still being adhered to (See Quarterly Report No. 1). Evaluation of the third technology is almost complete and plans are being made for the fourth technology transfer.



The second year project plant (Appendix E) is completed, and it is expected that the transfers, evaluations, and reports will be completed according to the schedule.

July and August will be a busy period because of the necessity of attending a coordination meeting with the North Carolina State University project director, coordination meetings with Georgia Tech's Industrial Development Division field office heads at Douglas and Albany, and participation in the Southeastern Mobile Home Institute at Mobile, Alabama, on August 5-8.

A considerable amount of time will be used during the final quarter to evaluate all of the technology transfers and to prepare the final report.

#### Fifth Quarter Plans

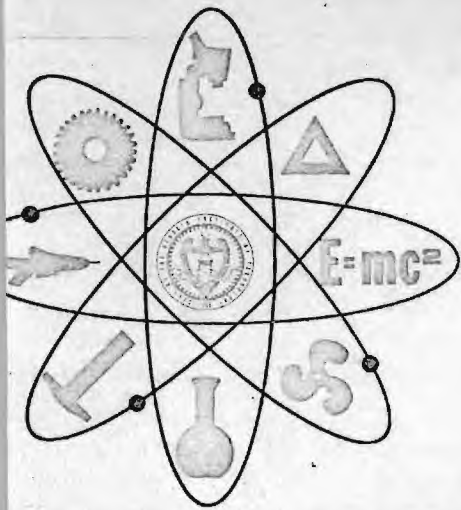
Fifth quarter activities will include new technology search and study, continued evaluation of the third transfer, preparation and transfer of the fourth technology, coordination meetings with North Carolina State University and Georgia Tech's field office personnel, and participation in the SEMHI convention in Mobile, Alabama.

## APPENDICES

# TECHNOLOGY FROM TECH

INDUSTRIAL DEVELOPMENT DIVISION  
ENGINEERING EXPERIMENT STATION  
GEORGIA INSTITUTE OF TECHNOLOGY

1132 WEST PEACHTREE STREET, N.W., ATLANTA, GEORGIA 30309



Under a grant from the United States Department of Commerce, Office of State Technical Services, with matching funds from Georgia Tech, staff members of Tech's Industrial Development Division are working on a two-year project to transfer new technology to the mobile homes manufacturing industry.

## TECHNOLOGY TRANSFER BULLETIN 1-69

### USE OF TEFLON-S IN THE MOBILE HOME MANUFACTURING INDUSTRY

"Of all the saws I ever saw I never saw a saw that saws like this saw saws."

The above statement is probably being repeated by several employees at Cullip Industries, Inc., Ellaville, Georgia, as a result of tests conducted at that plant during the past month.

The Industrial Development Division at Georgia Tech, in cooperation with Cullip Industries, Inc., recently completed a four-week test of several representative saw blades normally used in a mobile home manufacturing plant. The blades were coated with a new DuPont material, TEFLON-S, and the improvement in useful life (between sharpenings) was noted. A table of results of these tests, plus additional test results obtained in other applications is included herein.

Removal and re-placement of saw blades in a mobile home manufacturing plant is an expensive process. Would you like to reduce that cost to  $\frac{1}{2}$ ? .....  $\frac{1}{4}$ ? Then hear this!

TEFLON-S is a tough, non-wetting, non-stick, low-friction material that can be applied as a sprayed, dipped or rolled coating. It can be applied to 12-inch circular saw blades for about \$4.00 in lots of 1 to 9 and as little as \$2.10 in lots of 50 or more (see enclosed quotation from Vanguard Industries, Inc.). Tests have shown that carbide tip blades coated with TEFLON-S will operate considerably longer between cleanings and sharpenings than non-coated blades. At one furniture manufacturing plant the average running life of carbide tip rip saw blades was increased 36 times. At Cullip Industries a skill saw that normally

required sharpening every four days was still in operation at the end of four weeks.

Don't forget your wood drill bits, counter sinks, routers, shapers, etc. There isn't much test data available on these items, but it doesn't cost much to try them out. TEFLON-S is a fairly new material so we can't give you all the applications but we do plan to keep you advised on future developments.

Attached is a list of DuPont licensed industrial applicators and we are sorry to note that there are presently none in Georgia. However, many manufacturers send blades outside of Georgia to be sharpened so all that would be required would be to have the blade sharpener forward the blades to one of the licensed applicators. Since some of the applicators have stated that they can coat and ship blades the same day they are received, this should not add over two or three days to the time the blades will be out of the plant. We suggest that a quotation be obtained from the intended applicator similar to the attached quotation from Vanguard.

As you will note from the attached DuPont literature, the blade can be re-coated if the finish is damaged, but this is rarely ever necessary since normal scratches do not materially affect performance.

Take a good look at this new technology. We think you will be pleasantly surprised at the potential savings.



RESULTS OF TEFLON-S COATED SAW BLADE TESTS  
AT CULLIP INDUSTRIES, INC.

Blade Type	Application	Normal Time Between Sharpenings Prior to TEFLON-S Coating	Time Between Sharpening After Coating With TEFLON-S	Remarks
12" - carbide-tip	Gang rip saw	2 weeks	3 weeks	This blade hit a nail and had to be removed for sharpening. However, it had exceeded its previous useful life by 50%.
10" - carbide-tip	Table saw	1 week	2½ weeks	This blade exceeded its previous useful life by 250%.
10" - standard	Wood mouldings (finishing dept.)	4 days	5 days	It is believed that this blade may have been removed prematurely because of the critical cutting operation and the previous history of sharpening every week.
6" - standard	Skill saw	4 days	4 weeks (still in operation at end of 4 weeks)	This blade has exceeded our expectations.



INDUSTRIES, INC.

March 10, 1969

Mr. Richard Johnston  
Georgia Institute of Technology  
Industrial Development Division  
1132 W. Peachtree Street  
Atlanta, Georgia 30309

Dear Mr. Johnston:

I am happy that we were able to Teflon coat and ship four of your blades plus the shaper on Friday March 7th via United Parcel Service. Your one remaining blade was mailed to you on Saturday. To explain the necessity of mailing, it was necessary that we re-coat this one blade.

For your information, I am listing below our prices for Teflon coating circular saw blades with an 8" diameter.

Lots of 50 or more	1.50 ea.
Lots of 26 to 49	2.70 ea.
Lots of 10 to 19	3.10 ea.
Lots of 1 to 9	3.50 ea.

An additional charge of 30¢ will apply per blade for every two inch increase in diameter.

We are confident of the good results which you will get with your demonstration to the group of manufacturers, and we do appreciate this opportunity to work with you and hope that you will allow us to serve you often.

Yours truly,

Roy H. Boggs  
Executive Vice President

rhb/m



# PRODUCT INFORMATION SERVICE

E. I. DU PONT DE NEMOURS & COMPANY  
INCORPORATED

PUBLIC RELATIONS DEPARTMENT  
WILMINGTON, DELAWARE 19898

## FURNITURE INDUSTRY AWARD GOES TO "TEFLON-S" FINISH

Furniture manufacturers recently chose Du Pont's new, tough "Teflon-S" finish for cutting tools to receive one of seven first-place "Challenge To Change" awards. More than 100 products were entered in this competition which recognizes significant research and development contributions to the industry.

Trophies were awarded during the National Association of Furniture Manufacturer's Industrial Woodworking Machinery and Furniture Supply Fair, September 14-18, in Louisville, Ky. One other first-place recipient, American Machine & Foundry's Versatran Division, was a United States firm; four awards went to furniture machinery firms from the Republic of Germany; and one went to an Austrian machinery firm. AMF's entry was a fully automated and programmed robot for use with woodworking machines.

The "Challenge To Change" trophy is the second major award "Teflon-S" has received since it was introduced early last year. The first one, the "Popular Science Award," was announced by Popular Science Magazine in a special award issue last December as an

"outstanding contribution to American living in fields of interest to PS readers."

"Teflon-S" finish for carbide-tipped circular saws, drill bits, and other woodcutting tools was entered in the "Challenge To Change" competition after comparative furniture production tests indicated:

- Decreased production costs because more cuts could be made without gum building up and necessitating removal for cleaning.
- Less burning of the cut because the cutting tools produced less frictional heat.
- Precision cutting for a longer period of time because the undisturbed saw blades were allowed to "joint themselves in."
- Reduced frictional drag for less burden on machines.

Test results included evaluation at MPI Industries, Inc., Jackson, Miss., and Boro Wood Products Company, Inc., Bennettsville, S.C. MPI found a blade coated with "Teflon-S" ran 76 days before it had to be removed, not for cleaning, but for resharpening. Uncoated blades normally must be cleaned every eight hours to remove gum and resin build-up on the blade sides. Boro Wood also reported excellent results with blades coated with "Teflon-S" and indicated it intended to experiment further with carbide router bits and drill bits.

More than 30 hardware manufacturers are offering pruners, grass shears, saws, and other consumer items coated

with "Teflon-S" which provides such advantages as tool-cleaning ease, rust resistance, longer life, and easier operations.

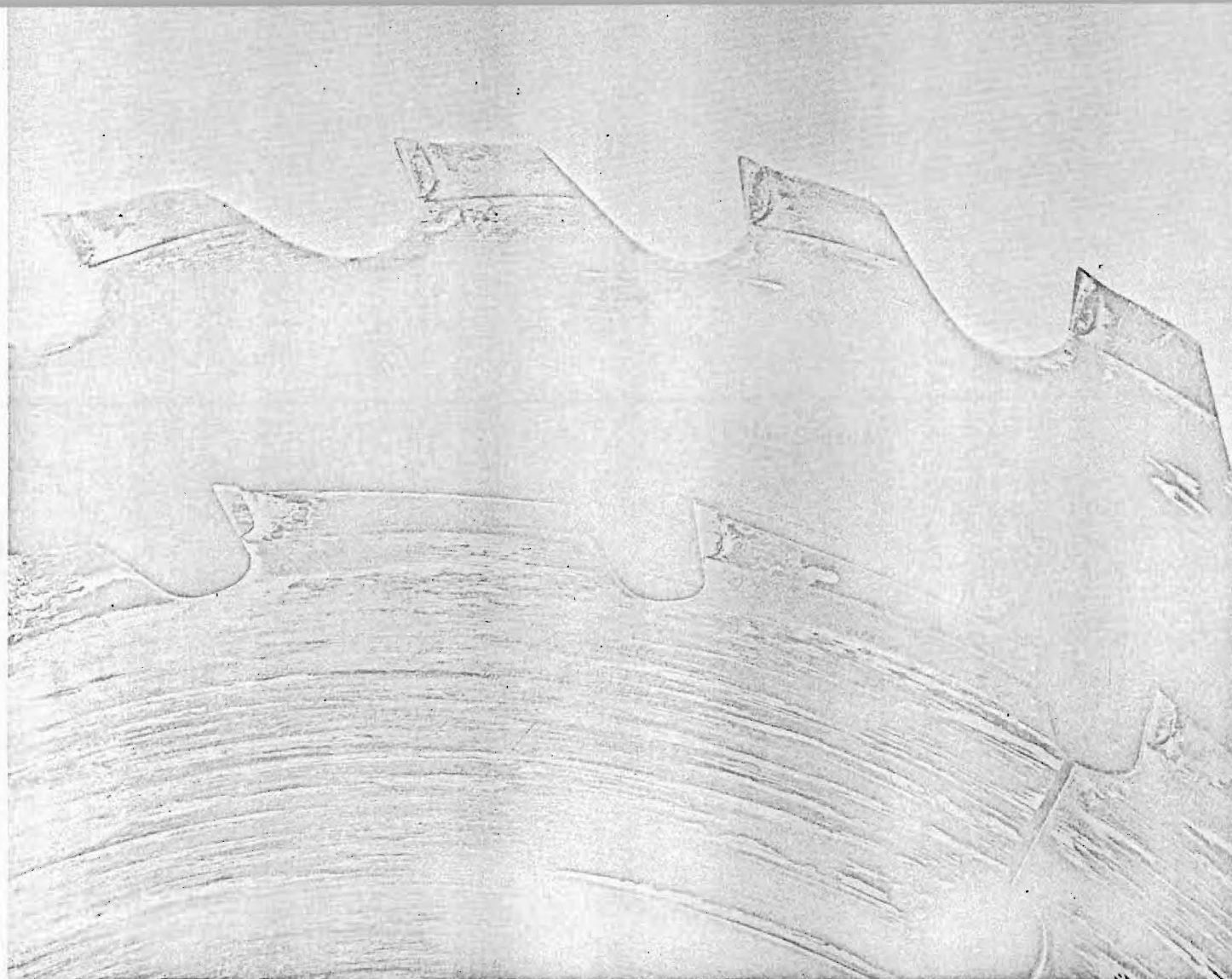
"Teflon-S" finishes also are used or being evaluated for a number of other industrial and institutional end uses such as a coating for conveyors, chutes, and other bulk materials-handling equipment; paper, textile and packaging machinery; many types of molds; and adhesive-bonding tools used in various types of manufacturing operations.

###

Editorial Contact: Lloyd E. Mackall, Public Relations Department, Du Pont Company, Wilmington, Delaware 19898.  
Telephone:

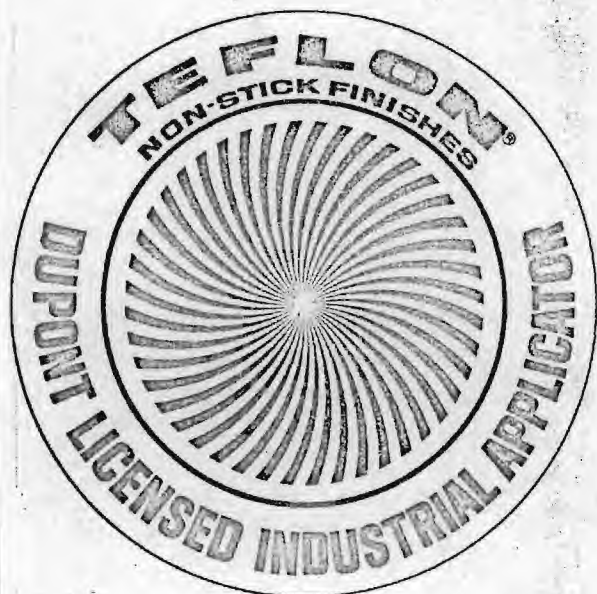
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Comparative furniture production tests were conducted at MPI Industries, Inc., Jackson, Miss., on a carbide-tipped circular saw coated with Du Pont's new tough "Teflon-S" finish (top) and a similar uncoated saw (bottom). The uncoated blade ran one eight-hour shift and had to be removed for cleaning because of excessive gum and resin buildup. The blade coated with "Teflon-S" ran for 76 days or 152 eight-hour shifts before it had to be removed because the teeth required resharpening. Furniture manufacturers recently chose "Teflon-S" finish to receive one of seven first-place "Challenge To Change" awards as a significant contribution to the industry. In addition to reducing sap buildup, the coating provides longer running time between resharpening, freer running in the cut and reduction of blade to wood friction for less motor drag.





## *Applying* **TEFLON\* and TEFLON-S\* finishes**

requires specialized techniques as well as considerable "know-how." To make a coating service available to you, we have licensed a number of qualified applicators. These applicators are identified by this emblem. It's your assurance that you are dealing with a firm qualified to apply TEFLON finishes.

\*Reg. U.S. Pat. Off. for Du Pont's non-stick finishes.

Questions  
and  
Answers  
about  
tools  
coated  
with

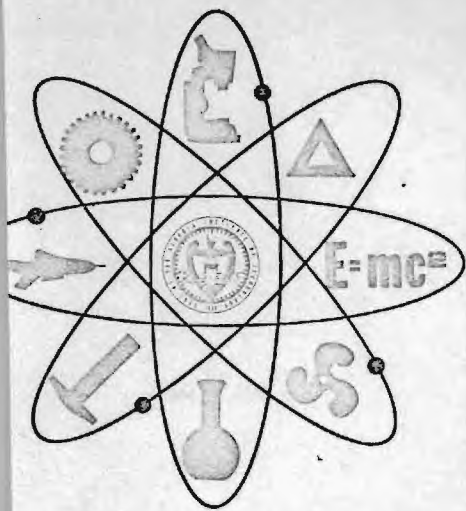
TEFLON-S



# TECHNOLOGY FROM TECH

INDUSTRIAL DEVELOPMENT DIVISION  
ENGINEERING EXPERIMENT STATION  
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Under a grant from the United States Department of Commerce, Office of State Technical Services, with matching funds from Georgia Tech, staff members of Tech's Industrial Development Division are working on a two-year project to transfer new technology to the mobile homes manufacturing industry.

## TECHNOLOGY TRANSFER BULLETIN 2-69

### USE OF TEFLON-S IN THE MOBILE HOME MANUFACTURING INDUSTRY

How much could you save annually if you increased the life of your saw blades by a factor of three or more? It can be done with DuPont's new TEFLON-S.

Take a look at the attached literature and see what the furniture manufacturing industry has accomplished with this material. Note that in one furniture manufacturing plant the average running life of carbide tip ripsaw blades was increased 36 times.

TEFLON-S is a tough, non-wetting, non-stick, low-friction material that can be sprayed, dipped or rolled. However, the application of TEFLON-S requires specialized techniques and should be applied only by a DuPont licensed company. A list of these companies is included in the enclosed DuPont pamphlet. As a means of determining the cost of having saw blades coated, we obtained the following quotation from Vanguard Industries, Inc., P. O. Box 789, Anderson, South Carolina 29621. (This firm does not appear on the DuPont list since they were licensed after the list was printed.):

Prices for coating 8" diameter saw blades	
Lots of 50 or more	\$1.50 ea.
Lots of 20 to 49	2.70 ea.
Lots of 10 to 19	3.10 ea.
Lots of 1 to 9	3.50 ea.
Add 30¢ per blade for each two inch increase in diameter.	



Since most mobile home manufacturers do not carry a large inventory of blades, we suggest that when you ship blades out to be sharpened, you have the sharpening company ship the blades to one of the applicators. We also suggest that you obtain a quotation from the intended applicator. Several firms have indicated that they can normally coat and ship blades the same day they are received.

Take a good look at this new technology and use it to save some of those maintenance expenses. Don't just stop with saw blades either. Try it on your drill bits, routers, counter sinks, etc. We don't have much additional data on other applications of TEFLON-S since it is a relatively new material. However, we will keep you advised of any new developments.

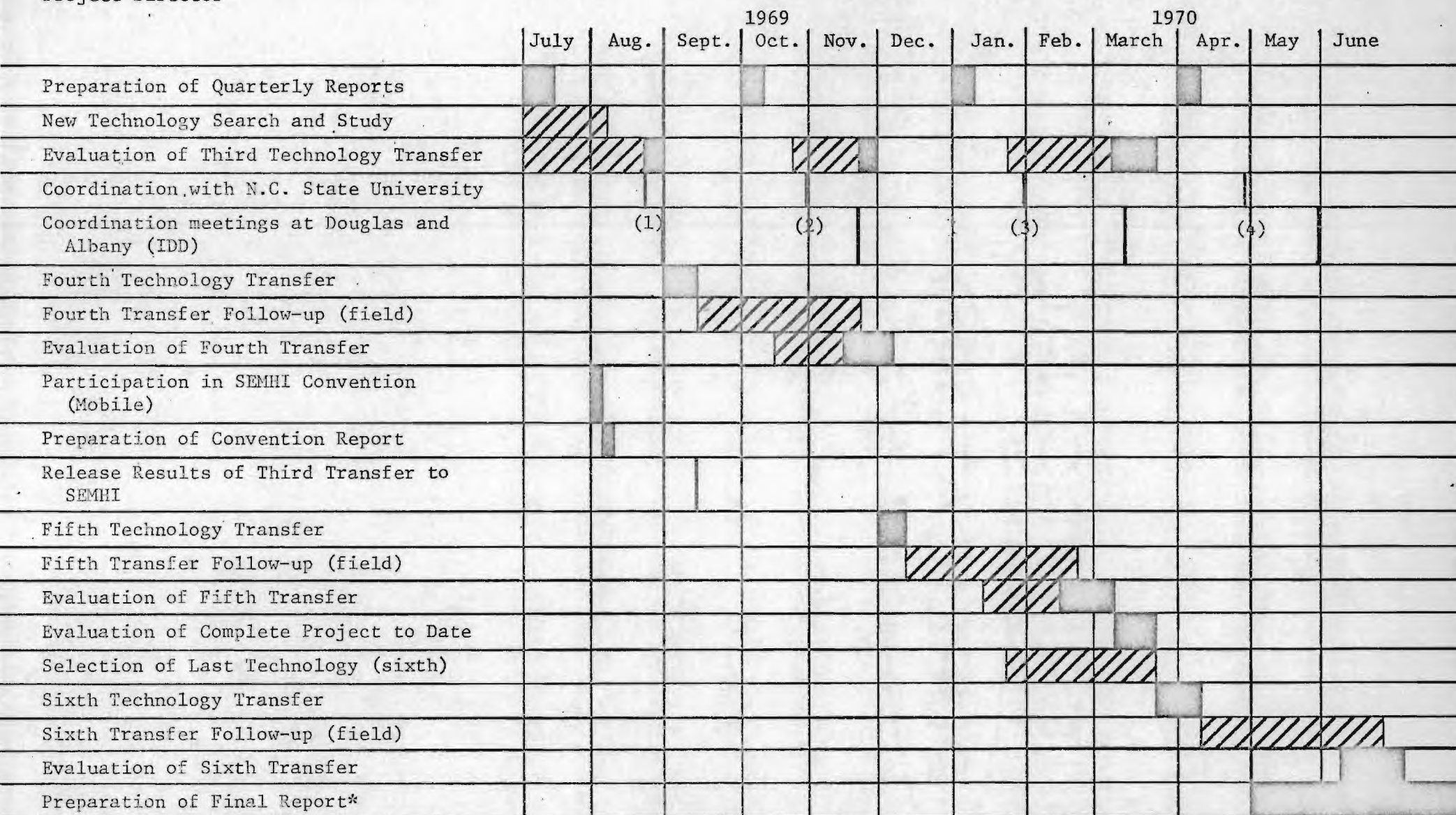
Action Taken by Company

	Group		Written		Personal		TOTALS		
	+	-	+	-	+	-	+	-	TOTALS
1.+ None but some indication of possible future adoption.	3		1		2		6		6
2.- None and no indication of ever intending to adopt technology.									
3.- Are presently using a similar technology and therefore will not use transferred technology.						1		1	1
4.- Were already using transferred technology.									
5.- Have previously used and discarded transferred technology.									
6.- Will not use new technology because it									
(a) Costs too much		1						1	1
(b) Too hard to adapt									
(c) Other									
7.- Did not remember seeing information or else someone had misplaced it or it had not been circulated.				2				2	2
8.- Information forwarded to company headquarters with no feedback from headquarters.		1		2		1		4	4
9.+ Information forwarded to company headquarters with or without feedback from headquarters and with some positive local action.	1						1		1
10.+ Information passed to local production people but with no action yet but indications that technology will be tried.					2		2		2
11.+ Technology now implemented or being implemented.					1		1		1
12.+ Technology information, acquired through B-343 project activities, being used by other non-contact companies.					2		2		2
13.+ Technology well received.	1				3		4		4
14.+ Wants to test technology locally.	1						1		1
	6	2	1	4	10	2	17	8	25

Action Taken by Company	Group		Written		Personal		TOTALS		
	+	-	+	-	+	-	+	-	TOTALS
1.+ None but some indication of possible future adoption.	4		4		2		10		10
2.- None and no indication of ever intending to adopt technology.		4		2		2		8	8
3.- Are presently using a similar technology and therefore will not use transferred technology.						1		1	1
4.- Were already using transferred technology.									0
5.- Have previously used and discarded transferred technology.		1		1				2	2
6.- Will not use new technology because it									
(a) Costs too much		4		3		1		8	8
(b) Too hard to adapt		2		1		1		4	4
(c) Other		2						2	2
7.- Did not remember seeing information or else someone had misplaced it or it had not been circulated.				4				4	4
8.- Information forwarded to company headquarters with no feedback from headquarters.		4		4		1		9	9
9.+ Information forwarded to company headquarters with or without feedback from headquarters and with some positive local action.	1						1		1
10.+ Information passed to local production people but with no action yet but indications that technology will be tried.					2		2		2
11.+ Technology now implemented or being implemented.					1		1		1
12.+ Technology information, acquired through B-343 project activities, being used by other non-contact companies.					7		7		7
13.+ Technology well received.	2		3		5		10		10
14.+ Wants to test technology locally.	1		1		1		3		3
	8	17	8	15	18	6	34	38	72



Project No. B-343  
 Project Title Mobile Homes - Technology Transfer  
 Project Director



\*Ask for 1 year technology transfer evaluation contract as a follow-up to this project

LEGEND



Part-time  
Full-time

Meetings with N.C. State

(1) At N.C. State (2) At Ga. Tech  
 (3) At N.C. State (4) At Ga. Tech



QUARTERLY REPORT NO. 5  
July 1, 1969, to September 30, 1969

A DEMONSTRATION OF THE APPLICATION OF TECHNOLOGY  
TRANSFER TECHNIQUES TO TWO CONTRASTING REGIONAL INDUSTRIES

A joint project with the Industrial Extension Service  
School of Engineering, North Carolina State University

Prepared for

OFFICE OF STATE TECHNICAL SERVICES  
U. S. DEPARTMENT OF COMMERCE

by Charles I. Poole, P. E.  
Project Director  
INDUSTRIAL DEVELOPMENT DIVISION

Georgia Tech Project B-343  
OSTS Grant No. 1310-001

1969



Engineering Experiment Station  
**GEORGIA INSTITUTE OF TECHNOLOGY**  
Atlanta, Georgia

QUARTERLY REPORT NO. 5  
(July 1, 1969 through September 30, 1969)

A DEMONSTRATION OF THE APPLICATION OF  
TECHNOLOGY TRANSFER TECHNIQUES TO TWO  
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UNITED STATES DEPARTMENT OF COMMERCE

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GEORGIA INSTITUTE OF TECHNOLOGY

September 30, 1969

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## BACKGROUND

In June 1968, the Office of State Technical Services, U. S. Department of Commerce, awarded grants totaling \$123,431, to be matched equally by state funds, to the Industrial Development Division (IDD) of the Georgia Institute of Technology and the Industrial Extension Service (IES) of North Carolina State University for a two-year joint Special Merit Project, effective July 1, 1968. The purpose of the program is to demonstrate the application of technology transfer techniques to two contrasting regional industries. In North Carolina, the upholstered furniture industry, a traditional industry with a reputation for being relatively slow to take advantage of technological change, was selected. In Georgia, the mobile home industry, an emerging industry generally considered to be technically advanced and receptive to innovation, was chosen.

### Objectives

The overall objectives of the joint program are to identify the most effective methods of technology transfer and to determine whether they differ for traditional and emerging types of industry.

Objectives of the Georgia Tech segment of the program (OSTS Grant No. 1310-001) are as follows:

1. To identify new technology appropriate to the mobile home industry within the State of Georgia, and to effectuate the transfer of that technology by various techniques.
2. To evaluate the relative effectiveness of the various techniques of technology transfer.

### Plan of Procedure

The first month of project activity in 1968 was devoted to preparation of a Plan of Procedure which was included in Quarterly Report No. 1 (July 1, 1968, to October 1, 1968). The plan set forth a detailed schedule of activity for the first year of the project and was divided into three phases.



Phase I - Initial Planning and Technology Search. Phase I was completed on schedule during the first quarter and is fully covered in Quarterly Report No. 1.

Phase II - First and Second Technology Transfer. Phase II was scheduled for completion during the third quarter and was partially reported in Quarterly Report No. 2 (October 1, 1968, to January 1, 1969). Except for extension of time for technology transfer effectiveness study, Phase II was completed on schedule and is reported herein.

Phase III - Third Technology Transfer and Project Evaluation. The third technology transfer scheduled for the third quarter was completed, but additional time will be spent evaluating this transfer during the fifth quarter.

#### Summary of First Quarter Activities

The first quarter was devoted to procedure planning, publicity releases, coordination with North Carolina State University, coordination with Industrial Development Division (IDD) field personnel, visits to mobile home manufacturing plants in Georgia, participation in the Southeastern Mobile Housing Institute (SEMHI) Convention, attendance at the Man and His Shelter Conference at the National Bureau of Standards, selecting contact companies, gathering and studying literature on new technology, and preparation for the first technology transfer.

#### Summary of Second Quarter Activities

The second quarter was devoted to the first technology transfer (use of the Gang-Nail system of roof truss fabrication), evaluation of transfer effectiveness of the first transfer, and selection and transfer of the second technology (urethane foam insulation). A report on the second technology transfer was included in Quarterly Report No. 3.

#### Summary of Third Quarter Activities

The third quarter was devoted to the third technology transfer (Teflon-S for saw blades, shapers, drill bits, etc.), evaluation of transfer effectiveness for this technology, and preparation of a new Project Plan (schedule) for the second year of the project.

#### Summary of Fourth Quarter Activities

The fourth quarter was devoted to the completion of the third technology transfer (Teflon-S coating for wood cutting tools) and the monitoring of the results of this transfer, along with earlier transfers. The selection and evaluation process was continued for future technology transfer subjects. The end of the fourth quarter marked the departure of Harry L. Stiltz, project director for the first year.

## FIFTH QUARTER ACTIVITIES

### Prologue

The plan of procedure for this Special Merit Project envisioned the rhythmical repetition of Phase II and Phase III during the fifth, sixth and seventh quarters of the two-year project. The departure of Harry L. Stiltz and the search for, and selection of, a qualified successor consumed the month of July, 1969. This interval interrupted the rhythm, but the effect was minimized by the efforts of Frank J. Clarke and Richard Johnston. Charles I. Poole, P.E., assumed the duties of Project Director August 4, 1969.

### Southeastern Mobile Housing Institute, Second Annual Meeting

Frank J. Clarke and Charles I. Poole attended the Southeastern Mobile Housing Institute's (SEMHI) second annual meeting in Mobile, Alabama, on August 5-8, 1969.

SEMHI is a regional mobile living association providing services for seven southeastern state associations. SEMHI devotes its entire efforts and finances to one goal--enhancing the image of mobile housing to attain full sales potential at the grass roots level.

An excellent program was presented, highlighted by a presentation by S. Porter Driscoll, Director of the Architectural Division of FHA-HUD, of "Operation Breakthrough."

Another presentation, of special interest, was made by R. Douglas Kerr, representing the Southern Furniture Manufacturers' Association. Mr. Kerr gave the background and status of "Operation Bluesky", the joint project of SEMHI and the Southern Furniture Manufacturers Association to develop and demonstrate a mobile home designed and decorated by the Home Economics Department of the University of North Carolina.

Attendance at this meeting enabled the Project Director to meet many of the leaders of the mobile housing industry, several of whom participate in our Special Merit Project. Of some disappointment was the obvious lack of interest in research projects that would enhance the position of the industry in the future and a related reluctance to consider the production of modular housing to fill a well documented present requirement.



#### Coordination with North Carolina State University

Mr. Frank J. Clarke and Charles I. Poole visited Mr. E. L. Briggs, Jr., Project Director, Special Merit Project, North Carolina State University, Raleigh, North Carolina, on September 3, 1969. This visit provided an opportunity for the two Project Directors to become acquainted and to coordinate plans for the ensuing year. Some time was spent with John Hart and John R. Canada of North Carolina State University's Industrial Extension Service.

#### Fourth Technology Transfer

The search for meaningful technology, which might become the subject of a technology transfer, is an almost continuous process. The fact that direct labor costs in the mobile home plant represent a low percentage of the total cost of a mobile home (nationally, 8 to 12 percent) tends to eliminate those techniques requiring sizeable investments in labor saving devices. In general, their costs simply are not amortizable over any reasonable period of time. Earlier quarterly reports have recognized the shortage of management personnel induced by the burgeoning growth of the mobile housing industry. This trend is very evident in Georgia. During the first eight months of 1969, Georgia Development News identified twelve new or enlarged mobile home manufacturing plants in Georgia. At this point in time, it appears that management personnel, involved in a struggle to establish themselves and meet unprecedented production demands, are not receptive to innovative techniques.

The three earlier technology transfers were production oriented, i.e., automatic roof truss assembly through use of a Gang-Nail system; an improved insulation technique using Urethane, foamed in place; and the application of a new material, Teflon-S, to saw blades and other wood cutting and shaping blades. Each of these transfers involved different levels of technical sophistication, but all could be classed as "hard" technology.

Cooperating with North Carolina State University, the fourth transfer involved management ("soft") information. Use was made of a presentation prepared for the upholstered furniture industry. The presentation includes a booklet which is a printed reproduction of a lecture given by

Prof. Arthur X. Deegan, II, of the University of Michigan, before the Fortieth Annual Convention of the National Association of Furniture Manufacturers. The title of the booklet is "Management By Objectives." Also included was an interview-checklist designed to implement the recommendations contained in the booklet. Bulletin 3-69 (See Appendix A) was prepared to transmit the package. Also included was a questionnaire designed to update Project files on responsible individuals in each firm, generalized production information and interest in receiving information concerning possible new products they might manufacture.

These packets are being delivered to all mobile home manufacturing plants in Georgia. Industrial Development Division field personnel are delivering them in the Albany/Douglas areas. Other areas will be covered by mail. At the quarter's end, these deliveries are still being made. (See Appendices).

#### Fifth Technology Transfer

As the quarter ended, a subject had been selected for the next transfer and the art work and other supporting data were being prepared.

#### Evaluation of Previous Transfers

Implementing the decision reported in Quarterly Report No. 4, the evaluation periods for transfer effectiveness have been extended and these evaluations, for prior transfers, are continuing. Although subsequent Quarterly Reports may contain preliminary evaluations, the Final Report will contain the final evaluation of all transfers.

#### Sixth Quarter Plans

Sixth quarter activities are expected to include the continuing search for, and evaluation of, appropriate subjects for transfer, the transfer of the fifth technology evaluation of previous transfers, coordination meetings with Georgia Tech's field office personnel and response to peripheral informational queries.

#### Miscellanea

There have been a number of interesting spin-offs related to the various technology transfers.



IDD's Henry C. Sawyer has used the information, developed for the Teflon-S transfer, in contacts with wood working industries undertaken as part of Industrial Services.

Project staff members of Georgia Institute of Technology and North Carolina State University were instrumental in bringing the Southern Furniture Manufacturers Association (SFMA) and the Southeastern Mobile Housing Institute (SEMHI) together to cooperate in a program of innovation in mobile home furnishings. With financial support of the two associations, a mobile home will be provided by a SEMHI member and interior design will be performed by the Home Economics staff of the University of North Carolina, using products of members of SFMA. There is a strong possibility that the mobile home will be insulated with urethane--a direct result of the urethane technology transfer initiated in Georgia and subsequently repeated in North Carolina. Another probable innovation is the use of rough sawn finished plywood for the exterior skin of the mobile home.

Through a contact in Georgia Tech's Industrial Development Division, Kurt Salmon Associates Inc., a leading southeastern management consulting firm, will participate in the furniture round table conferences initiated by North Carolina State University.

## CONCLUSION

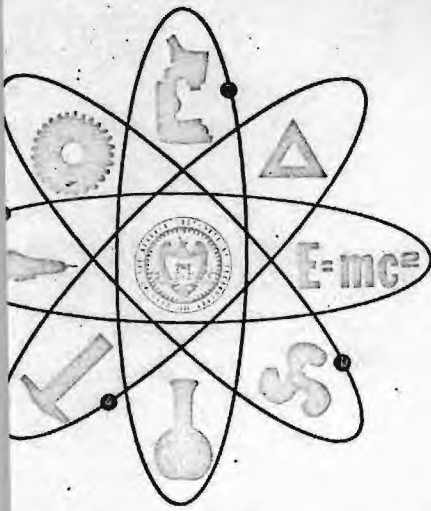
### Observations

At the conclusion of the quarter, the project is essentially on schedule. It appears that the successful transfer of technical information is perhaps a much slower process than had been anticipated, and that for best results, there must be continuing support and stimulation for even rather simple, basic concepts to be adopted. The more sophisticated concepts require a long educational process.

# TECHNOLOGY FROM TECH

INDUSTRIAL DEVELOPMENT DIVISION  
ENGINEERING EXPERIMENT STATION  
GEORGIA INSTITUTE OF TECHNOLOGY

1132 WEST PEACHTREE STREET, N.W., ATLANTA, GEORGIA 30309



Under a grant from the United States Department of Commerce, Office of State Technical Services, with matching funds from Georgia Tech, staff members of Tech's Industrial Development Division are working on a two-year project to transfer new technology to the mobile homes manufacturing industry.

## TECHNOLOGY TRANSFER BULLETIN 3-69

### MANAGEMENT BY OBJECTIVES

The project to transfer new technology to the mobile home industry, being conducted by the Industrial Development Division of Georgia Institute of Technology, is a joint program conducted in cooperation with the Industrial Extension Service of North Carolina State University. North Carolina State University is working with the upholstered furniture industry.

One of the most popular programs E. L. Briggs, Jr., Project Director for North Carolina State University, has presented concerns "Management By Objectives" (MBO), a technique which has received wide acceptance in the management profession.

Our purpose here is two fold. First, there is included a booklet entitled "Management By Objectives" by Arthur X. Deegan, II, which contains an Interview-Checklist (green) used as a part of this technique. Also included is a Techno-Gram (yellow) prepared by N.C.S.U. to introduce you to Management By Objectives. Please remove the bottom portion of the yellow Techno-Gram and mail it to the address shown, after checking the appropriate squares. This form may also be used for ordering additional Interview-Checklists.

Second, we want to compile an up-to-date directory of mobile home/modular housing firms now operating in Georgia, and some generalized production information. The attached questionnaire has been designed to require a minimum amount of time to complete. Upon receipt of these completed questionnaires, a directory will be compiled and made available to the industry and other interested parties.

Help us help you - complete the bottom portion of the yellow sheet and mail it to North Carolina State. Complete the white questionnaire and mail it to the address shown.



APPENDIX B

MOBILE HOME/MODULAR HOUSING  
QUESTIONNAIRE

Name of Firm \_\_\_\_\_

Mailing Address \_\_\_\_\_

Plant Location \_\_\_\_\_

Town \_\_\_\_\_, Georgia \_\_\_\_\_ Zip Code \_\_\_\_\_

Telephone Number \_\_\_\_\_

Affiliated with/Subsidiary of

Name \_\_\_\_\_

Mailing Address \_\_\_\_\_

Responsible Individual to Contact:

Name \_\_\_\_\_ Title \_\_\_\_\_

We produce ☐ Mobile Homes ☐ Modular Housing

Mobile Homes are:

☐ 10 wides ☐ 12 wides ☐ double wides ☐ other \_\_\_\_\_

☐ 40' 49' long ☐ 50' 59' long ☐ 60' 69' long ☐ other \_\_\_\_\_

Average Production: \_\_\_\_\_ per day.

Plant configuration:

☐ End-to-end ☐ Side-by-side ☐ Combination

Approximate size: \_\_\_\_\_ sq. ft.

We produce Modular Units for:

☐ Housing ☐ Offices ☐ Classrooms ☐ Motels ☐ Other \_\_\_\_\_

Widths of units: \_\_\_\_\_

Lengths of units: \_\_\_\_\_

Are you interested in hearing about new products your firm might make ☐ yes ☐ no

Return Questionnaire to:

Charles I. Poole, P.E.  
Industrial Development Division  
Georgia Institute of Technology  
1132 W. Peachtree Street N. W.  
Atlanta, Georgia 30309

## UPHOLSTERED FURNITURE INDUSTRY



# TECHNO-GRAM

**IES**INDUSTRIAL EXTENSION SERVICE  
SCHOOL OF ENGINEERING**NCSU**NORTH CAROLINA STATE UNIVERSITY  
RALEIGH, NORTH CAROLINA**OSTS**OFFICE OF STATE TECHNICAL SERVICES  
U. S. DEPARTMENT OF COMMERCE**SFMA**SOUTHERN FURNITURE MFG. ASSN.  
HIGH POINT, NORTH CAROLINA

AUGUST 20, 1969

WHERE DO YOU PLAN TO GO ON YOUR NEXT VACATION? OBVIOUSLY, YOU WILL TALK IT OVER FIRST AND DECIDE WHERE YOU WANT TO GO. THEN YOU WILL PROBABLY GET OUT A ROAD MAP, LOCATE YOUR DESTINATION, AND DECIDE ON THE BEST ROUTE TO IT.

CAN YOU IMAGINE LOADING ALL THE KIDS IN THE CAR, STARTING THE ENGINE AND SAYING, "WELL, WHERE SHOULD WE GO?" IT IS SURPRISING HOW MANY BUSINESSES ARE RUN JUST THAT WAY WITH ALMOST NO IDEA WHAT THE COMPANY'S GOALS ARE FOR NEXT YEAR, OR FOR FIVE OR TEN YEARS FROM TODAY.

MANAGEMENT BY OBJECTIVES IS A PROCEDURE FOR DECIDING WHERE YOUR BUSINESS MUST BE IN ONE, FIVE, AND TEN YEARS AND FOR CREATING AN UNDERSTANDING AMONG ALL IMPORTANT EMPLOYEES HOW BEST TO ACHIEVE THE GOALS AGREED UPON. THE TRIP'S DESTINATION IS DECIDED, AND THE BEST ROUTE TO IT IS LAID OUT AS COMPLETELY AS POSSIBLE.

AS MANAGER OF A SUCCESSFUL BUSINESS, YOU PROBABLY ARE USING EVERY DAY THE TECHNIQUES OUTLINED IN THIS BOOKLET, THOUGH PERHAPS NOT IN THIS FORMAL SYSTEM. WE HOPE THIS WRITING WILL HELP YOU TO ORGANIZE YOUR PLANNING AND SECURE AGREEMENT AMONG ALL HANDS ON THE BEST WAY TO ACCOMPLISH YOUR COMPANY'S GOALS.

IF YOUR COMPANY IS ONE OF THE MANY WHICH NOW USES MBO, WE HOPE THE INTERVIEW CHECKLIST WILL APPEAL TO YOU AS A GOOD WAY OF PUTTING ON RECORD THE ASSIGNMENTS OF EACH MAN AND DEPARTMENT. "MBO. . . THE BEST WAY WE KNOW NOW TO DO THE JOB OF BEING A MANAGER."

E. L. BRIGGS, JR.  
PROJECT DIRECTOR

-----CUT ON THIS LINE-----

TG-13 INDUSTRIAL EXTENSION SERVICE  
School of Engineering  
North Carolina State University  
Box 5506  
Raleigh, North Carolina 27607

- ☐ Our company is now using MBO.  
☒ We plan to begin using MBO.  
☐ Please send a free supply of MBO Interview-Checklists. We will require \_\_\_\_\_ copies.  
☐ Add my name to the free IES Newsletter subscription list.

We have this criticism of the MBO program:

NAME

TITLE

COMPANY

CITY



QUARTERLY REPORT NO. 6  
October 1, 1969 through December 31, 1969



A DEMONSTRATION OF THE APPLICATION OF TECHNOLOGY  
TRANSFER TECHNIQUES TO TWO CONTRASTING REGIONAL INDUSTRIES

A joint project with the Industrial Extension Service  
School of Engineering, North Carolina State University

Prepared by

OFFICE OF STATE TECHNICAL SERVICES  
U. S. DEPARTMENT OF COMMERCE

by Charles I. Poole, P. E.  
Project Director  
INDUSTRIAL DEVELOPMENT DIVISION

Georgia Tech Project B-343  
OSTS Grant No. 1310-001



Engineering Experiment Station  
**GEORGIA INSTITUTE OF TECHNOLOGY**  
Atlanta, Georgia

QUARTERLY REPORT NO. 6  
(October 1, 1969 through December 31, 1969)

A DEMONSTRATION OF THE APPLICATION OF  
TECHNOLOGY TRANSFER TECHNIQUES TO TWO  
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Prepared for  
  
OFFICE OF STATE TECHNICAL SERVICES  
UNITED STATES DEPARTMENT OF COMMERCE

by  
  
Charles I. Poole, P.E.  
Project Director

A joint project with the  
Industrial Extension Service  
School of Engineering  
North Carolina State University

Industrial Development Division  
Engineering Experiment Station  
GEORGIA INSTITUTE OF TECHNOLOGY

December 31, 1969

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## BACKGROUND

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The second quarter was devoted to the first technology transfer (use of the Gang-Nail system of roof truss fabrication), evaluation of transfer effectiveness of the first transfer and selection and transfer of the second technology (urethane foam insulation). A report on the second technology transfer was included in Quarterly Report No. 3.

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The third quarter was devoted to the third technology transfer (Teflon-S for saw blades, shapers, drill bits, etc.), evaluation of transfer effectiveness for this technology, and preparation of a new Project Plan (schedule) for the second year of the project.

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The fourth quarter was devoted to the completion of the third technology transfer (Teflon-S coating for wood cutting tools) and the monitoring of the results of this transfer, along with earlier transfers. The selection and evaluation process was continued for future technology transfer subjects. The end of the fourth quarter marked the departure of Harry L. Stiltz, project director for the first year.

#### Summary of Fifth Quarter Activities

The fifth quarter marked the arrival of Charles I. Poole, P.E., to assume the position of project director. Frank J. Clarke and Charles I. Poole attended the Southeastern Mobile Housing Institute's second annual meeting in Mobile, Alabama, on August 5-8, 1969. A coordination meeting was held at Raleigh, North Carolina, between Frank Clarke and Charles I. Poole, representing Georgia Tech, and E. L. Briggs, Jr., John Hart and Dr. John R. Canada, representing North Carolina State University. The fourth technology transfer (Management By Objectives) was completed. Material for the fifth technology transfer was prepared.

## SIXTH QUARTER ACTIVITIES

### Fifth Technology Transfer

As part of the orientation and familiarization with this Special Merit Project, the Project Director visited (and continues to visit) various manufacturers of mobile homes. In addition to familiarization, the visits provided an opportunity to observe areas in which there is a possibility for worth-while technology transfers.

In the initial visit, it was observed that production workers were performing finishing operations and other close, detailed work requiring good light which was not available. When questioned, the workers stated that regular extension cords, with incandescent lamps, generated too much heat and added to the worker's discomfort. There was the additional hazard that the lamp would come in contact with finished surfaces, such as the walls, drapes or carpet, and burn these surfaces. It was also observed that as the mobile home neared the end of the production line, there were a multiplicity of air and electrical lines in the doorway. These multiple lines not only had to be removed as the mobile home moved to successive stations, on the production line, but they represented a hazard to employees carrying material, tools, furniture, etc., through the doorway. Subsequent visits to other plants substantiated these observations. Some plants had fabricated light stands from large wood spools. Others had fabricated a "shoe-shine box" like device which included a multiple electric outlet and a light. All of these devices used incandescent lamps without any type of guard.

The aircraft industry, when faced with similar problems, utilizes a cool fluorescent lamp on an extension cord for lighting and a multiple outlet air receiver (called a "pig") to reduce the number of air lines in a work area.

Discussions with the field personnel and others connected with the project developed a consensus that these so-called "production aids" should become part of a transfer. Technology Transfer Bulletin 4-69 (see Appendix A) was prepared outlining the idea and giving instructions

for fabricating and/or purchasing the aids.

In keeping with our decision to use three methods of transfer, i.e., by written materials, direct personal transfer and group presentation, it was decided that additional material should be used in the group presentation to justify bring the sample group together. Because of a rather extensive background in plant engineering, the Project Director, in visits to the mobile home manufacturing plants, had made it a point to discuss the pneumatic system (which all mobile home plants have, but utilize in varying degree) with his escort. It became obvious, to the Project Director, that plant personnel had little technical knowledge concerning these systems and almost universally failed to service filtering and tool lubricating devices normally installed as part of the pneumatic system. The Project Director decided to include, in the group presentation, a seminar on compressed air systems. Arrangements were made to have examples of the production aids available. Mr. Robert L. Pound, District Sales Manager for Bostitch, agreed to make a presentation covering the elements to be considered in the design and operation of a compressed air system. Bostitch air tools are widely used in the mobile home manufacturing industry in Georgia. During the planning sessions, Mr. Pound commented that Bostitch had encountered considerable resistance to their recommendations for adequate pneumatic systems and a general tendency, on the part of the mobile home manufacturer, to blame the tool for operating problems that were actually related to inadequate pneumatic air systems.

Although the general plan for this transfer had been discussed in some detail with one of IDD's field representatives, when the invitations (See Appendix B) were mailed to the field offices for distribution, the value of the transfer was questioned by the field personnel. As a result, a quick survey was made among a few of the members of our sample. This survey confirmed the initial impression of the field personnel. As a result, it was decided to cancel the group presentation and to make the transfer by written and personal contact only. Appendix C lists the firms in each of these categories. Appendix D summarizes the field personnel's feelings.



This summary does indicate that there is a problem, of some magnitude, in this area. At least one, out of four, firms had experienced "burning up of compressors", a major and expensive component of the pneumatic system. It also suggests that the transfer of technology, already available from commercial sources, although desirable under the parameters of this project, may not be acceptable to the industry.

It is of at least passing interest, that the first plant the Project Director visited (albeit a North Carolina firm) subsequent to these incidents, was also experiencing at least one problem. In the station where the underlayment was installed in the floor system, two operatives were using air tools to nail the underlayment to the framing system. Three operatives were following after the first two, using common hammers to finish driving the nails. When the foreman was questioned about this practice, he indicated that he felt the air tools were not operating properly because of lack of pressure. A careful check of the system revealed condensate in the lines and other indications of a lack of maintenance on the system, but in spite of these conditions pressure was well within the recommended limits for the tool. The real problem was the lines supplying the tools. They were too small to move the volume of air the tools required.

All of which points to an interesting dilemma. How do you provide assistance (or should you even attempt to do so) to a firm which is unable to recognize that a problem even exists?

#### Seventh Quarter Plans

Seventh quarter activities are expected to include preparation and transfer of the sixth (and final) technology, coordination meetings with the North Carolina State Project Director and Georgia Tech's IDD personnel and response to peripheral informational queries. A Georgia mobile home manufacturers' directory probably will be issued.

#### Miscellanea

An article on technology transfer was prepared for the STATE TECHNICAL SERVICES NEWSLETTER. See Appendix E.

The Project Director accompanied a group of Latin American professionals, participants in the International Internship Program conducted by IDD's International Development Section, on a tour of a mobile home manufacturing plant at Gainesville, Georgia.

The Project Director participated in applying urethane insulation on the walls and roof of the mobile home being built as a joint project between the Southeastern Mobile Housing Institute and the Southern Furniture Manufacturers Association in their "Operation Bluesky."

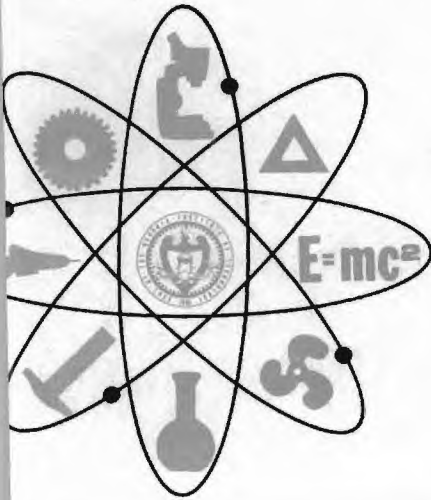
Arrangements were completed for MOBILE HOME/RECREATIONAL VEHICLE DEALER magazine to publish a series of monthly technical articles, utilizing technology transfer subjects from this Project where possible, prepared by the Project Director. A copy of the initial article is included as Appendix F.

# TECHNOLOGY FROM TECH

INDUSTRIAL DEVELOPMENT DIVISION  
ENGINEERING EXPERIMENT STATION  
GEORGIA INSTITUTE OF TECHNOLOGY

1132 WEST PEACHTREE STREET, N.W., ATLANTA, GEORGIA 30309

Under a grant from the United States Department of Commerce, Office of State Technical Services, with matching funds from Georgia Tech, staff members of Tech's Industrial Development Division are working on a two-year project to transfer new technology to the mobile homes manufacturing industry.



## TECHNOLOGY TRANSFER BULLETIN 4-69

### PRODUCTION AID FOR THE MOBILE HOME MANUFACTURING INDUSTRY

Earlier Technology Transfers have involved a new component manufacturing technique (automatic roof truss assembly through use of a Gang-Nail system), an improved insulation technique (Urethane, foamed in place), and the application of a new material (TEFLON-S) to saw blades and other wood cutting and shaping tools.

Now let's consider some production aids that should:

- o Reduce clutter in the manufacture of Mobile Homes
- o Improve working environment
- o Reduce distances production workers must walk
- o Reduce time to clear Mobile Homes for movement to next station

First, consider a multiple outlet air receiver which is known as a "pig" in the aircraft manufacturing industry. Figure No. 1 depicts a basic design although variations are encouraged to make the "pig" more adaptable to specific applications. To reduce pressure loss, the air line supplying the "pig" should be kept as short as practicable and a 3/4-inch line is recommended although a 1/2-inch line may suffice, if plant air pressure is adequate.

One suggestion is to place a "pig" in the mobile home as it moves down the line, with each workman connecting his tools to the "pig", eliminating the many individual air lines in the doorway. Shorter individual air lines could be used. When the mobile home is advanced to the next station, each worker removes his tools and lines and the fore-

man removes the air line supplying the "pig". As the mobile home moves from station to station, the process is repeated. On the other hand, the "pig" could be removed and kept at the same station all of the time.

And how about applying the same idea for the electrical tools? Although there are such extension cords available commercially, Figure No. 2 provides the basic information necessary to fabricate one in-plant. Again, the cord should be kept as short as practicable and used with a 20 amp. or larger circuit. You could go one step further and mount the outlet box on the end of the "pig". See Figure No. 3.

One final suggestion. Have you considered using "cool" lights for illuminating the interior of the mobile home as it moves along the production line? This modern adaptation of the fluorescent lamp provides a light on an extension cord which is cool, light weight and casts no shadows - a real boon to employee comfort and efficiency. An attached sheet describes one such light which is commercially available.



FIGURE 1

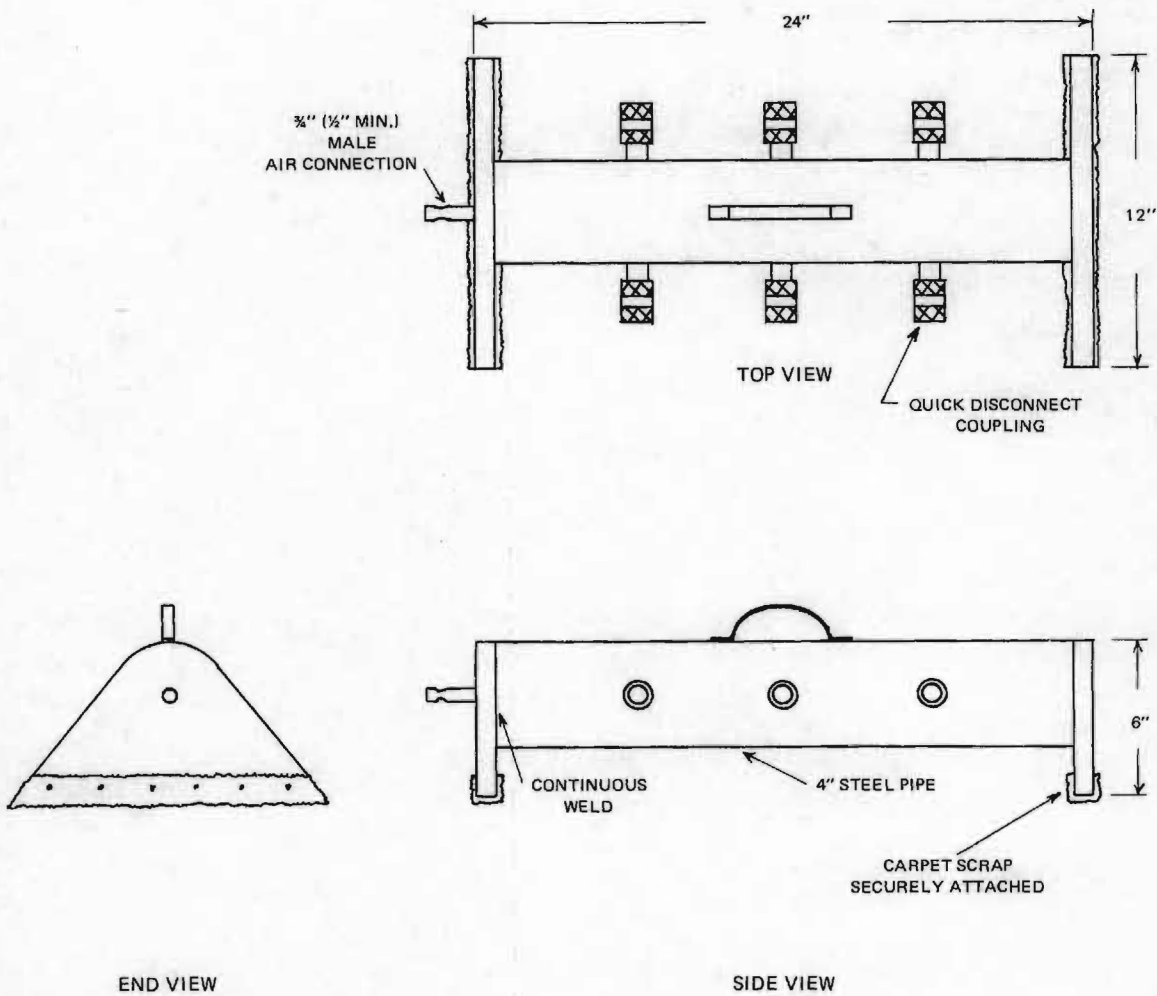


FIGURE 2

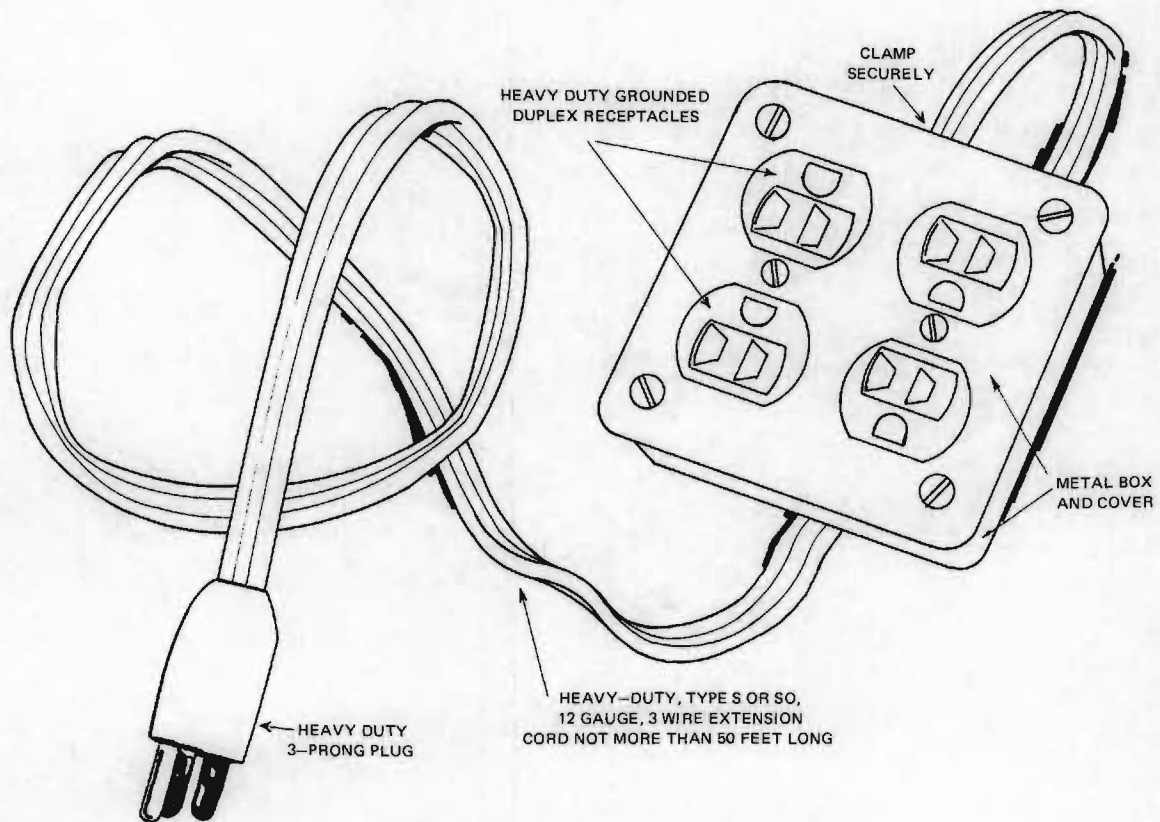
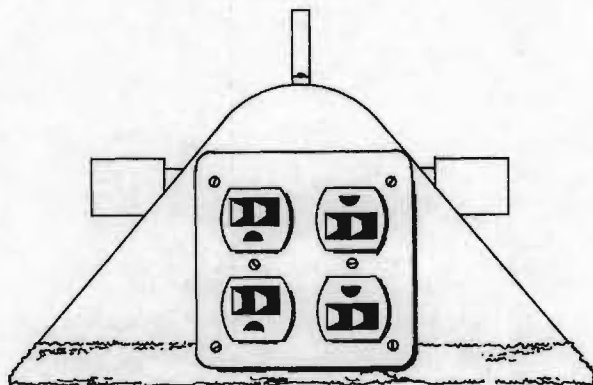


FIGURE 3



# Safety Yellow® FLUORESCENT PORTABLE HAND LAMP

Available thru: WHITMAN ASSOCIATES  
313 Bona Allen Building  
Atlanta, Ga. 30303  
Phone 521-0977

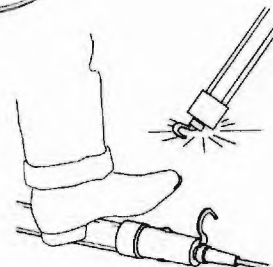
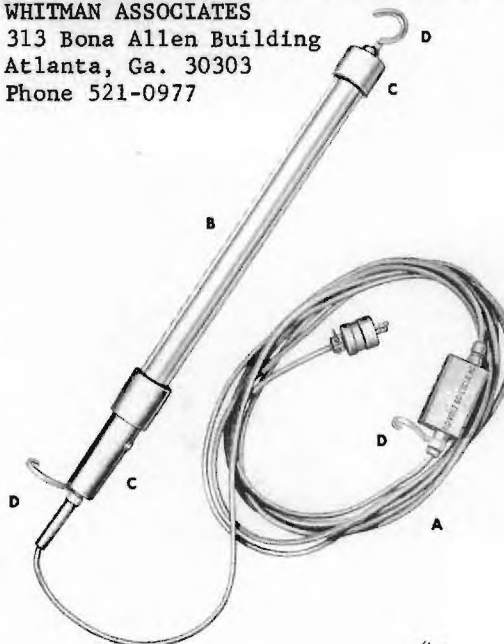
Compact, heavy duty trouble lights for those jobs requiring maximum light, minimum heat, and utmost safety.

- "SAFETY YELLOW" quality built into hand lamp and cord set.
- The Fluorescent Hand Lamp offers superior resistance to physical abuse.
- "SAFETY YELLOW" NEOTEX® DOUBLE INSULATED construction of handle, cord set and ballast does not require grounding.
- Available in either 15 Watt or 30 Watt size, with various length cords.

## CHECK THESE FEATURES:

Lamp Specifications	15W.	30W.
Lumen Output: (initial).....	750	1900
(at 40% rated life).....	620	1600
Lamp Life: (hours).....	7500	—
Hand Lamp size: 2" dia., length.....	25"	42"

- A** Safety Yellow Cord with replaceable back-wired SAFEWAY Plug Cap.
- B** Shockproof, virtually unbreakable plastic shield protects fluorescent tube, guards against shattered glass.
- C** Handles and end caps: Oil-Proof Safety Yellow Neotex handle and caps seal around plastic shield.
- D** Two special hinged hooks on hand lamp and one on ballast permit mounting in any position.



## DURABILITY

Impact resistant plastic shield protects fluorescent tube.

Fluorescent Lamp with: #18 AWG Cord, 600 V. rating	Catalog No.	
	15 Watt	30 Watt
25 feet cord, #1404 plug cap.....	1003	
35 feet cord, #1404 plug cap.....	1004	
50 feet cord, #1404 plug cap.....	1005	
25 feet cord, grounded type #1447 plug cap.....	1003-3	1008-3
35 feet cord, grounded type #1447 plug cap.....	1004-3	1009-3
50 feet cord, grounded type #1447 plug cap.....	1005-3	1010-3

Your distributor can service your replacement lamp requirements. If not, please get in touch with us.

Lamp numbers are as follows:

15 Watt Model..... All Manufacturers, #F 15 T 8/CW  
30 Watt Model for Twinlamp..... All Manufacturers, #30 T 8/CW  
"Black Light" lamps are also available to fit the 15 watt unit. Specify #F 15 T 8BLB

**DANIEL WOODHEAD COMPANY**

# TECHNOLOGY FROM TECH

INDUSTRIAL DEVELOPMENT DIVISION  
ENGINEERING EXPERIMENT STATION  
GEORGIA INSTITUTE OF TECHNOLOGY

1132 WEST PEACHTREE STREET, N.W., ATLANTA, GEORGIA 30309

Under a grant from the United States Department of Commerce, Office of State Technical Services, with matching funds from Georgia Tech, staff members of Tech's Industrial Development Division are working on a two-year project to transfer new technology to the mobile homes manufacturing industry.

YOU ARE CORDIALLY INVITED TO ATTEND

A COMPRESSED AIR SYSTEM AND AIR TOOL SEMINAR

and

A DEMONSTRATION OF PRODUCTION AIDS

at

GEORGIA POWER COMPANY  
102 North Prince Street  
Americus, Georgia

2:00 P.M.  
TUESDAY, NOVEMBER 25, 1969

This presentation should be of interest to Managers, Production Superintendents and others responsible for plant operation. Coffee and donuts will be served following the presentation.

WE SELL IDEAS - NOT PRODUCTS



APPENDIX C

MEMORANDUM

November 25, 1969

TO: Chuck Poole  
FROM: Bill Studstill  
SUBJECT: Technology Transfer--Bulletin # 4-69

We have decided upon the following arrangement for the transfer:

Personal

Cullip  
Champion  
Parkwood  
Redman  
Marlette

Mail

Plantation  
De Rose  
Cavalier  
Brigadier

WTS:jh

November 26, 1969

MEMORANDUM

To: Chuck Poole

From: O. M. Wellslager, Jr.

Subject: Technology Transfer #5 (Technology Transfer Bulletin 4-69)

The transfer will be set up as follows:

1. The mail group will be composed of:
  - a. Biltmore Mobile Homes, Inc.
  - b. Fleetwood Mobile Homes, Inc.
  - c. Skyline Homes, Inc.
  - d. Souvenir Enterprises
  - e. Broadmore Mobile Homes, Inc.
2. The personal transfer group will be composed of:
  - a. Bowen Mobile Homes
  - b. Armour Mobile Homes
  - c. Douglas Homes, Inc.
  - d. Liberty Homes
  - e. Gregory Mobile Homes, Inc.
  - f. Valiant Mobile Homes

Chuck, I hope this schedule will meet with your approval. A copy of the attached cover letter will be used in both sets of transfers.

November 17, 1969

MEMORANDUM

To: Chuck Poole

From: O. M. Wellslager, Jr.

Subject: Proposed Technology Transfer - Pneumatic Systems

Chuck, this memorandum is for record keeping purposes only as we have already had a telephone conversation regarding this transfer. This morning Eric and I had a conversation. The net upshot of this was that we felt the transfer was of such a nature that it would work very effectively for a letter or in a plant visit regarding this subject; however, both of us are reluctant to ask people to come from 100 miles or more to Americus to see a demonstration that an effective company such as Bostitch should already have shown within the individual plants.

To further complicate my feelings, I have talked to four firms between Friday and today. In all of these firms the only air system problem has been the burning up of compressors. Perhaps we can draw a conclusion that air systems are not as utilized or demanded upon as perhaps they are in the aircraft industry.

In conclusion, I think it is fair to say that we would like to put on a real professional presentation of objects and capabilities not readily available to the vast majority of mobile home plants. We hope you will understand our position; and further, we hope that our position will not complicate matters for you too much.

OMWjr/vbs

CC: Mr. Eric Newsom





# STS

## STATE TECHNICAL SERVICES NEWSLETTER

Route to—See Page

U.S. DEPARTMENT OF COMMERCE/Office of State Technical Services

Vol. V, No. 1, January 1970

### Special Merit Projects in North Carolina and Georgia Experiment with Various Methods of Technology Transfer

Technology Transfer to  
Furniture Industry in North Carolina

by E. L. Briggs, Jr.  
STS Special Merit Project Director  
North Carolina State University

Technology Transfer to  
Mobile Home Industry in Georgia

by Charles I. Poole,  
STS Special Merit Project Director  
Georgia Institute of Technology



*Project Director, E. L. Briggs, Jr. examines a device designed by Mr. Willard Hicks for making better back posts. The procedure used became a subject of technology transfer in the Special Merit Project.*

Our Special Merit Project was set up with two goals. Working in a single industry, the manufacture of upholstered furniture, the first aim was to find technology of interest and value to that industry and to transfer that technology to people in the industry. Then we are to evaluate their acceptance of our efforts and see how methods used may be adapted for use in other industries.

The finding of technology has been relatively easy. Most transfer subjects have been solutions to industry problems. In our searching we have formed the opinion that the problems which furniture people face may be classified as either tangible or intangible. Tangible problems present themselves to the manager every day in his use of materials, machinery, or people. Intangible problems are the subtle ones which many companies do not realize they have. Intangible problems are solved by systems or methods such as production control, inventory management, motivation or quality control.

Evaluation, fortunately, has been readily measured in numbers of responses or actual use of our services.

To accomplish the transfer of technology, three methods were used: group discussions, transfer by

(Continued on Page 2)

At the same time that OSTS awarded a grant to North Carolina State for the evaluation of methods of reaching a tradition based industry, the upholstered furniture business, Georgia Tech received a grant to examine the response of the mobile home industry, thought to be responsive to innovation. It was anticipated that there would be differences in the degree of acceptance depending upon the method used to offer the innovation. It was also possible that there might be differences in techniques needed to optimize acceptance in each industry.

The overall objectives of the joint program are to identify the most effective methods of technology transfer and to determine whether they differ for traditional and emerging types of industries.

In conferences between the two state groups, it was decided that three techniques for transferring technology would be evaluated. These were group presentation, transfer by written material, and direct personal transfer and in-plant assistance. These were considered to be equal or, at least, parallel methods for dissemination of technology. In Georgia, a carefully selected sample of mobile home manufacturers was divided into three groups and the three transfer techniques, mentioned above, are used to transfer the same basic information. Subsequently, field personnel canvass the manufacturers periodically to determine the degree of acceptance of the transfer.

Although it is too early, at this point in time, to reach definite, statistically supportable conclusions some general observations do seem appropriate. It now appears that the three techniques may not be equal in effectiveness. The reaction time between the introduction of a new technology and its adoption is much longer than might have been expected, particularly if one contrasts an industry eager for new ideas with one tradition oriented. The identification of appropriate subjects for transfer, within the constraints of the program, has proved to be more formidable than anticipated. Plant managers, of Georgia plants belonging to national firms, often lack the authority to institute relatively minor

(Continued on Page 4)



## STATE TECHNICAL SERVICES NEWSLETTER

### U.S. DEPARTMENT OF COMMERCE



Maurice H. Stans, Secretary  
Rocco C. Siciliano, Under Secretary  
Dr. Myron Tribus, Assistant Secretary  
for Science and Technology  
OFFICE OF STATE TECHNICAL SERVICES  
Roger Gilbertson, Acting Director

**Prepared by:**

**Office of  
State Technical Services  
Washington, D.C., 20230**

*(Continued from Page 1)*

written materials, and direct personal transfer and in-plant assistance.

Thus far, we have held eight meetings such as an "Upholstery Round Table," a discussion of "The True Cost of Carrying Inventory," and a lecture on "The Chemistry of Plastics for Furniture People." We have learned a great deal from them. On the practical level, the most important lesson has been never to plan such a gathering without a local co-sponsor. With people on the scene who can stimulate attendance, arrange advance publicity, and share responsibility for drawing an audience, the chances for success are at least doubled. We have found Chambers of Commerce to be attracted to this sort of activity, and that other groups such as industrial management clubs are also interested.

A point against meetings is that they are not as effective in reaching top management people as they are for supervisors and engineers. The typical executive is involved in community, church, and business organizations to such an extent that he has far, far too many meetings already. He resists them and is impatient to leave if he comes at all. The important advantage of the group discussion is that it permits the transmission of the greatest possible amount of knowledge in the least amount of time. A two hour meeting can easily cover much of the material contained in a good sized book, and audience participation permits attention to points which concern each person. We feel that tangible or "hard" technology is best adapted to this transfer method.

Written materials are probably the best channel of communication to busy people. A small, easily carried publication can be read at the recipient's own pace and at a time convenient to him. Subjects such as "A Breakeven Chart for Your Company," "Better Back Posts," "Management by Objectives," and "Incentive Pay for the Cutting Room" have been described in booklet form and mailed to furniture men. We have sent 16 such publications and have had a gratifying response to them. The project mailing list includes 593 names and 183 of these, 31 percent, have responded to one or more offerings. We find, though, that a writing of this sort must be looked upon as a "sales pitch." It must be interest-

ing and readable. If it isn't read, it never does anything for anybody. The more technical aspects of our subjects have been covered by offering reprints of more sophisticated writings to those people who wish to go more deeply into the subject matter. Generally, it can be said that intangible or "soft" technology can best be transferred in this manner.

At the outset of the project, it was assumed that the third transfer method, direct personal transfer and in-plant assistance, was a pathway equal or parallel to the other two. We now feel that this is not the case. An eyeball-to-eyeball encounter can be much more effective than any amount of lecturing or printed material. However, it is impossible to be effective in a man's plant until he invites you there and has a reason for wanting you. Here, though, the other two methods can really earn their keep. In their own ways, group meetings and mailed writings are excellent door-openers. In our project, they have told people that we are in business, where our skills lie, and how we can help them.

In an article, "Champions for Radical New Inventions," in *Harvard Business Review* for March-April 1963, Donald A. Schon states that almost every company has one or more persons who serve as "champions of technology." These are the people who have a personal interest in technology and the inside company knowledge to see that something is done with it. We believe that they are exactly the people who have responded to our group meetings and mailings of written materials. Follow-up calls on these men permit us to spend our time where it does the most good and to be effective in our work. In fact, the greatest frustration of the project has been that we have not had enough time or people to make the plant visits to take full advantage of the excellent entrée generated by our other efforts.

Furthermore, working with a man in his plant, we are able to transfer technology in a most effective manner and almost always show tangible dollars-and-cents benefits to the company at the same time. The two functions in no way inhibit each other; in fact, there is no question but that there is synergistic effect. Each activity benefits substantially from the presence of the other, and the total result is greater than the sum of its parts.



An interesting sidelight on our work is that we began with the hypothesis that upholstered furniture was a "traditional" industry and that there might be some slowness or resistance to change. This has proved to be anything but true. Properly stimulated, furniture people quickly see the benefits of applic-

able technology, and they have responded to our efforts in exciting ways. We are pursuing our project goals with good effectiveness and at the same time rendering dollars-and-cents-service to the industry. It has been a great challenge and a thrilling experience.

## PATENT OFFICE BRIEFING CONFERENCE

Commissioner of Patents William E. Schuyler, Jr., has extended an invitation to federal and state officials associated with the State Technical Service program to participate in the third annual Patent Office briefing conference for college engineering and science faculty and students March 6.

The primary purpose of the one-day conference is to familiarize college teachers, students, and others with the operation of the American patent system and its contribution to American industrial development, and to demonstrate how this resource may be most fully utilized in industry, not only as a means of industrial property protection, but also as a primary source of new technical information.

Over 50 colleges and universities were represented at the first two annual conferences, as well as a number of federal and state agencies including State Technical Services. The Patent Office feels that although the conference was initially conceived and directed toward the colleges, it has proved of equal interest to others concerned with industrial development and the transfer of technology.

Issuing between 60,000 and 70,000 new patents a year and with the almost 3½ million issued to date classified for searching by subject, the Patent Office is perhaps the world's largest repository of applied technical information. While the product described in a patent cannot be manufactured and sold during the 17-year life of the patent without

the consent of the owner, the technical data contained in patents can be utilized.

The program begins at 8:30 the morning of March 6, with registration from 7:30 to 8:30, and will be concluded about 4:30.

The morning session will include opening remarks by Commissioner Schuyler and talks by Dr. Myron Tribus, Assistant Secretary of Commerce for Science and Technology, Richard A. Wahl, Assistant Commissioner of Patents, and by a prominent inventor on "The Inventor and the Patent System" and a business executive on "Patents in Industry."

The Patent Office Society will host a luncheon for all participants. The afternoon session will be devoted to on-the-job briefing by senior patent examiners in the Patent Office's mechanical, chemical, and electrical examining operations emphasizing special problems and techniques unique to particular areas of technology.

There is no fee or other charge by the Patent Office for participation. Each participant is responsible for his own travel and lodging.

Anyone wishing to attend should contact the Office of Information Services, Patent Office, U. S. Department of Commerce, Washington, D. C. 20231, prior to February 16. (Telephone 703-557-3428.) The Patent Office plans to mail information materials to those planning to attend in advance of the meeting.

## PROJECT TO CONSIDER LIBERAL ARTS FOR ENGINEERS

Should engineering students take more social science and humanities courses?

Do the liberal arts contribute relevant information to undergraduate engineering?

A project to look at these and related problems, and to develop ways to incorporate effective liberal arts studies in undergraduate engineering education, will be undertaken under a grant announced by the National Science Foundation.

NSF has granted \$24,032 to the American Society for Engineering Education, of Washington,

D. C., to conduct a three-day work session in mid-June under the direction of Dr. Henry W. Knepler of the Illinois Institute of Technology. College teachers, administrators, social scientists, and humanists will be paired with engineers at the session, to be held on the IIT campus in Chicago.

In deciding to support this experimental project, the National Science Foundation has taken into account the seriousness with which engineering educators view the decline in college engineering enrollments. In 1957 the ratio of freshmen enrolling in



engineering courses to all freshmen was 23 percent; today it is only 13 percent. Many engineering educators feel that this decline is due at least in part to student feeling that there is little relationship between engineering and human values or social processes. This project is designed to encourage engineering graduates to want to accept more significant and sensitive roles in society, and to give them the prospects for making sound contributions to society as well as to their profession.

In addition, the project represents a follow-up to the report, "Liberal Learning for the Engineer," prepared by the ASEE Humanistic-Social Research Project under the direction of Professor Sterling P. Olmsted. The Olmsted Report, published in the December 1968 *Journal of Engineering Education*,

makes two important points:

1. Engineering education must come to treat the humanities and social sciences as part of the context of engineering, not as an adjunct or a separate "stem."
2. Both engineering and liberal arts institutions are very far from any concrete realization of the meaning of this basic idea, let alone its implementation.

The objective of the ASEE work session is to bring liberal arts and engineering people together to examine the problem and attempt to solve it cooperatively. The participants will be selected from institutions that are or can be committed to action, and the participants are expected to devise suitable action programs for their own institutions.

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(Continued from Page 1)

changes. The characteristics and present circumstances in the industry may tend to explain these conditions.

The burgeoning mobile home manufacturing industry is faced with an unprecedented demand for its product. Based on figures from the Mobile Homes Manufacturers Association, Georgia ranks third in the nation in mobile homes shipped the first eight months of 1969. Production had increased 56% over year earlier figures (15,554 vs. 9,992). The adequacy of technical and managerial skill is undoubtedly a problem in all industries, but it is especially acute in the mobile home industry in Georgia. Mobile home manufacturing is not a highly labor intensive industry. Nationally, only 8% to 12% of the cost of a mobile home is attributable to direct labor costs. Thus, techniques involving sophisticated or expensive equipment are not acceptable, for their adoption would make little or no change in over-all costs.

It has been suggested that perhaps the mobile

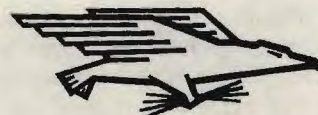
home manufacturing industry suffers from "technertial".<sup>1</sup> More likely, it is virtually impossible for any rapidly expanding industry, thinly staffed with experienced engineers and managers, to take time to evaluate innovations. Since the marketing of mobile homes does not center on price competition, at the consumer level, it is difficult to justify expenditures for frequent innovations in product or production techniques. Relatively superficial styling changes occur frequently and these provide product differentiation which another industry could accomplish only through redesigning.

This project has successfully demonstrated the benefits of regional cooperation and that the exchange of ideas between industries can be mutually beneficial. The Project Directors feel that project activity and technology transfer are going on as fast as effective organization and evaluation will allow and that project objectives are being met.

<sup>1</sup> Definition: Slowness to adopt new technology. Coined by Neil Roberts, *STEEL*, January 1962.

**U.S. DEPARTMENT OF COMMERCE**  
**Office of State Technical Services**  
Washington, D.C. 20230

OFFICIAL BUSINESS



POSTAGE AND FEES PAID  
U.S. DEPARTMENT OF COMMERCE



# Coated Blades

by CHARLES POOLE

**T**HE mobile home manufacturing industry is unique in many ways. On the other hand, many of the materials and techniques used in the industry have been adapted from other industries. Innovative use of these ideas has enabled the mobile home industry to provide the best value in housing available in America today.

The furniture industry has pio-



**CHARLES L. "Chuck" Poole, 48,** received a B.S. in industrial engineering from Texas Technological College in 1948. He was with Pioneer Natural Gas Company from 1948 to 1959, finally as division engineer-distribution. Following a year of consulting engineering work, he was general manager and engineer for C & C Construction Company and president of Chuck Poole, Inc., designing and building commercial buildings from 1960 to 1964. He joined Litton Systems, Inc. in 1964, first as plant engineer and later as senior industrial engineer. Moving to Lockheed-Georgia Company in 1967, he served as senior customer facility engineer. He joined the staff of Georgia Tech's Industrial Development Division in August, 1969, where he is project director for a project to identify new technology appropriate to the mobile home industry in Georgia.

Poole is a registered professional engineer in the states of Alabama, Arkansas, Georgia, Louisiana, Missouri, New Mexico, Oklahoma and Texas. He presented a paper before the American Institute of Plant Engineers' International Seminar in New York, December, 1968, and is the author of several publications concerning the new generation of jumbo jets and airport compatibility. He serves as an engineering consultant with Manufactured Housing Consultants, 3110 Maple Drive, N. E., Atlanta, Georgia.

DECEMBER 20, 1969

neered an area that has considerable potential for mobile home manufacturers. I refer to the use of Teflon-S as a surface finish for circular saw blades and other wood cutting and shaping tools. This new Du Pont finish has received several awards since its introduction in 1967. Teflon-S is a tough, non-wetting, non-stick, low-friction material which can be applied to blades, already in use, by Du Pont licensed applicators. Costs vary, based on number and size of blades to be coated. A number of manufacturers have made Teflon-S coated blades a part of their product line. A commonly used 7 $\frac{1}{4}$ -inch, combination blade, Teflon coated, generally sells for about 60 cents (17%) more than the uncoated blade.

What advantages does this coating offer the mobile home manufacturer? Foremost is the extended time between sharpening and/or cleaning. One furniture manufacturer found that an uncoated blade that formerly required cleaning every eight hours, to remove gum and resin build-up on the blade sides, ran for 76 days (after coating) before it had to be removed, not for cleaning, but for resharp-ening. A Georgia mobile home manufacturer, using blades which were coated on an experimental basis, found that the coated blades exceeded their previous useful life by 250%—a very satisfactory return on a modest investment! Other benefits: less burning of the cut because the blades produce less frictional heat; reduced frictional drag for less burden on motors; reduced employee fatigue and the coated blades are rust and corrosion resistant.

The Teflon-S coating will last a long time with reasonable care. It can be scratched, but minor scratching won't affect the performance because most of the surface is still coated. The blades may be resharp-ened and reset, with no damage to the coating, just as you would any uncoated blade. Teflon-S is not recommended for metal cutting applications. ■■

MOBILE HOME/RECREATIONAL VEHICLE DEALER.



QUARTERLY REPORT NO. 7  
January 1, 1970 through March 31, 1970

A DEMONSTRATION OF THE APPLICATION OF TECHNOLOGY  
TRANSFER TECHNIQUES TO TWO CONTRASTING REGIONAL INDUSTRIES

A joint project with the Industrial Extension Service,  
School of Engineering, North Carolina State University

Prepared for

OFFICE OF STATE TECHNICAL SERVICES  
U. S. DEPARTMENT OF COMMERCE

by Charles I. Poole, P. E.  
Project Director  
INDUSTRIAL DEVELOPMENT DIVISION



Georgia Tech Project B-343  
OSTS Grant No. 1310-001



Engineering Experiment Station  
GEORGIA INSTITUTE OF TECHNOLOGY  
Atlanta, Georgia

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March 31, 1970

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## BACKGROUND

In June 1968, the Office of State Technical Service, U. S. Department of Commerce, awarded grants totaling \$123,431, to be matched equally by state funds, to the Industrial Development Division (IDD) of the Georgia Institute of Technology and the Industrial Extension Service (IES) of North Carolina State University for a two-year joint Special Merit Project, effective July 1, 1968. The purpose of the program is to demonstrate the application of technology transfer techniques to two contrasting regional industries. In North Carolina, the upholstered furniture industry, a traditional industry with a reputation for being relatively slow to take advantage of technological change, was selected. In Georgia, the mobile home industry, an emerging industry generally considered to be technically advanced and receptive to innovation, was chosen.

### Objectives

The overall objectives of the joint program are to identify the most effective methods of technology transfer and to determine whether they differ for traditional and emerging types of industry.

Objectives of the Georgia Tech segment of the program (OSTS Grant No. 1310-001) are as follows:

1. To identify new technology appropriate to the mobile home industry within the State of Georgia, and to effectuate the transfer of that technology by various techniques.
2. To evaluate the relative effectiveness of the various techniques of technology transfer and draw inferences for subsequent technology transfer efforts.

### Methods

In order to assess the effectiveness of various means of technology transfer specific technological developments will be disseminated through the following means:

1. Group Presentations. This will include the use of workshops, seminars or demonstrations at which technological development will be introduced and explained.



2. Written Materials. Technological developments that lend themselves to this use will be distributed to participating companies in the form of letters, article copies, circulars or newsletters.

3. Direct Personal and In-Plant Assistance. Technological developments will be conveyed to participating companies by personal visit of a project engineer who will interpret the information relative to the participating companies and will provide technical assistance in applying the developments.

#### Plan of Procedure

The first month of project activity in 1968 was devoted to preparation of a Plan of Procedure which was included in Quarterly Report No. 1 (July 1, 1968, to October 1, 1968). The plan set forth a detailed schedule of activity for the first year of the project and was divided into three phases.

Phase I - Initial Planning and Technology Search. Phase I was completed on schedule during the first quarter and was fully covered in Quarterly Report No 1.

Phase II - First and Second Technology Transfer. Phase II was scheduled for completion during the third quarter and was partially reported in Quarterly Report No. 2 (October 1, 1968, to January 1, 1969). Except for extension of time for technology transfer effectiveness study, Phase II was completed on schedule.

Phase III - Third Technology Transfer and Project Evaluation. The third technology transfer scheduled for the third quarter was completed, but additional time will be spent evaluating this transfer during subsequent quarters.

#### Summary of First Quarter Activities

The first quarter was devoted to procedure planning, publicity releases, coordination with North Carolina State University, coordination with Industrial Development Division (IDD) field personnel, visits to mobile home manufacturing plants in Georgia, participation in the Southeastern Mobile Housing Institute (SEMHI) Convention, attendance at the Man and His Shelter Conference at the National Bureau of Standards, selecting contact companies, gathering and studying literature on new technology, and preparation for the first technology transfer.

#### Summary of Second Quarter Activities

The second quarter was devoted to the first technology transfer (use of the Gang-Nail system of roof truss fabrication), evaluation of transfer effectiveness of the first transfer and selection and transfer of the second technology (urethane foam insulation). A report on the second technology transfer was included in Quarterly Report No. 3.

#### Summary of Third Quarter Activities

The third quarter was devoted to the third technology transfer (Teflon-S for saw blades, shapers, drill bits, etc.), evaluation of transfer effectiveness for this technology, and preparation of a new Project Plan (schedule) for the second year of the project.

#### Summary of Fourth Quarter Activities

The fourth quarter was devoted to the completion of the third technology transfer (Teflon-S coating for wood cutting tools) and the monitoring of the results of this transfer, along with earlier transfers. The selection and evaluation process was continued for future technology transfer subjects. The end of the fourth quarter marked the departure of Harry L. Stiltz, project director for the first year.

#### Summary of Fifth Quarter Activities

The fifth quarter marked the arrival of Charles I. Poole, P.E., to assume the position of project director. Frank J. Clarke and Charles I. Poole attended the Southeastern Mobile Housing Institute's second annual meeting in Mobile, Alabama, on August 5-8, 1969. A coordination meeting was held at Raleigh, North Carolina, between Frank Clarke and Charles I. Poole, representing Georgia Tech, and E. L. Briggs, Jr., John Hart and Dr. John R. Canada, representing North Carolina State University. The fourth technology transfer (Management By Objectives) was completed. Material for the fifth technology transfer was prepared.

#### Summary of Sixth Quarter Activities

The fifth technology transfer (Production Aids) was modified from the initial plan and the transfer completed during this quarter. An evaluation

of our technology transfer subjects and methodology was performed. Arrangements were completed for a series of monthly articles, utilizing technology transfer subjects where possible, to be published in a leading mobile home industry magazine.



## SEVENTH QUARTER ACTIVITIES

### Sixth Technology Transfer

The rejection of our initial attempt at a technology transfer concerning pneumatic systems, during the Sixth Quarter, resulted in an evaluation of our techniques. An early, positive conclusion was that transfers involving commercial application of products or services available through normal industry sales channels were not looked upon with favor. The general reaction from the mobile home manufacturers was that they saw no value in meeting together for a demonstration when they could have the salesman make a presentation in their own facility (a form of direct personal transfer and in-plant assistance). The matter of selecting the technology to be transferred was also highlighted. Subjects which seemed relevant, to an outside observer, might be of no interest to the mobile home manufacturer for a number of complex reasons.

To meet these two basic conclusions, it was decided that the talents of Georgia Tech's faculty would be utilized to present a seminar on mobile home structural systems. This subject was suggested because of wide spread consumer complaints, particularly concerning mobile home floors and the announced intention of the State of Georgia (and other southeastern states), acting through the State Fire Marshal to enforce compliance with the law requiring mobile homes manufactured in Georgia conform to the Standard for Mobile Homes (USAS A119.1). A letter (see Appendix A) was mailed to all known mobile home manufacturers in Georgia and to the sample in North Carolina. A stamped, self-addressed post card was enclosed. The manufacturers were asked to indicate their interest in such a seminar and their preference for a day in the week to hold the seminar. A total of seventy-eight (78) letters and cards were mailed out. Twenty-seven (27) post cards (34%) were returned. Of these twenty-seven cards, three were negative and twenty-four positive. Of the twenty-four positive cards returned, seven expressed no preference for a day on which to hold the seminar. Six preferred Wednesday, with four preferring Friday. The balance were divided among the remaining days in the week.

A tentative date of either March 18th or March 25th was selected for the seminar and arrangements for speakers and facilities started. Because of the



ending of the winter quarter, and other conflicts, it became necessary to change the date to April 1, 1970.

During the interval in which the planning was underway, a number of inquiries came in from the field concerning technical aspects of the enforcement of the Standard for Mobile Homes (USAS A119.1-69). It was decided that the seminar should be expanded to include presentations by enforcement officials from Florida and Georgia. This decision was mentioned, in the course of conversations with some of Southeastern Mobile Housing Institute's (SEMHI) staff. An announcement (Appendix B) was mailed to all manufacturers in Georgia and the sample from North Carolina.

Having established the date, personnel and facilities, a letter was written to all industry newspapers and magazines and trade associations telling about the seminar. See Appendix C. Almost immediately, Mr. John B. Manley, Jr., Executive Vice President, SEMHI, called to say that he felt we were duplicating their effort relating to the code enforcement and requesting that we delete this topic from the seminar. We did so. Appendices D, E and F are copies of other information mailed, one each week, just prior to the seminar.

The seminar and its evaluation will be covered in the final report.

#### Eighth Quarter Plans

The final quarter will be utilized to evaluate the program and prepare a final report. The Project Director and other IDD personnel will participate in SEMHI's Fifth Annual Southeastern Mobile/Modular Housing Show. A meeting will be held between the Georgia and North Carolina Project Directors to coordinate the final report.

#### Miscellanea

E. L. Briggs, Jr., North Carolina Project Director visited IDD for conferences to coordinate the project on January 13, 1970.

Frank Clarke and Charles Poole met with George Pendley, SEMHI's new Director of Public Relations on January 16, 1970, to brief him on the project.

MOBILE HOME/RECREATIONAL VEHICLE DEALER Magazine continues to publish an article each month, written by the Project Director, designed to upgrade mobile home production techniques.

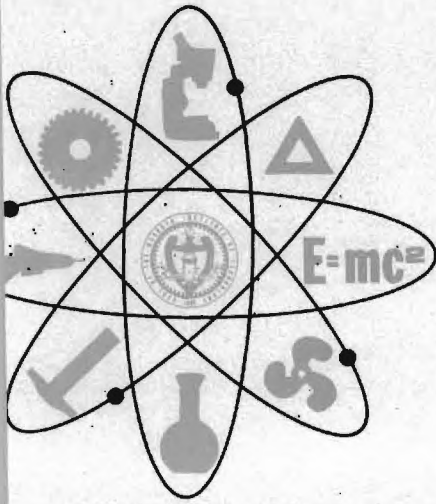
As a result of the technology transfer concerning TEFLON S, and various articles on the subject, the Project Director has been asked to present a paper before the Forest Products Research Society's annual meeting.

# TECHNOLOGY FROM TECH

INDUSTRIAL DEVELOPMENT DIVISION  
ENGINEERING EXPERIMENT STATION  
GEORGIA INSTITUTE OF TECHNOLOGY

1132 WEST PEACHTREE STREET, N.W., ATLANTA, GEORGIA 30309

Under a grant from the United States Department of Commerce, Office of State Technical Services, with matching funds from Georgia Tech, staff members of Tech's Industrial Development Division are working on a two-year project to transfer new technology to the mobile homes manufacturing industry.



## PROPOSED SEMINAR

We are contemplating holding a seminar on the factors involved in the design and construction of the chassis and floor system of mobile homes.

Present plans envision holding the seminar at Americus, Georgia, the later part of February or early March, 1970. The presentation would be made by qualified members of Georgia Tech's faculty and would be scheduled during the afternoon. There will be no charge to participants.

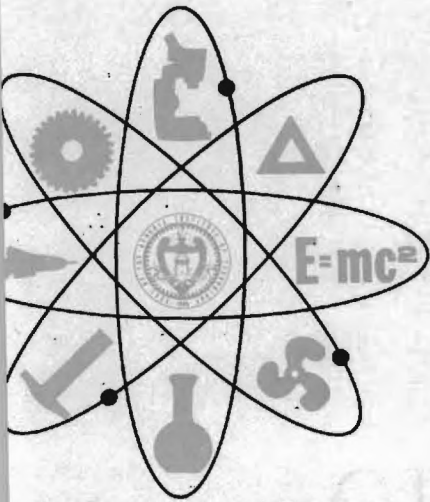
Please complete the enclosed card and return it by January 30, 1970, so that planning can be completed.

# TECHNOLOGY FROM TECH

INDUSTRIAL DEVELOPMENT DIVISION  
ENGINEERING EXPERIMENT STATION  
GEORGIA INSTITUTE OF TECHNOLOGY

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## FOR YOUR INFORMATION

Plans for the mobile home structural seminar are nearly complete. It has been expanded to include sessions on Code (A 119.1) enforcement.

Where: AMERICUS, GEORGIA

When: WEDNESDAY, APRIL 1, 1970

Morning Sessions: CODE ENFORCEMENT

Afternoon Sessions: STRUCTURAL DESIGN

NO CHARGE TO PARTICIPANTS

Complete details will be mailed to you shortly.



APPENDIX C



ENGINEERING EXPERIMENT STATION

GEORGIA INSTITUTE OF TECHNOLOGY

Industrial Development Division

1132 W. Peachtree Street  
Atlanta, Georgia 30309  
873-2931 Area Code 404

March 9, 1970

Mr. George Pendley  
Director of Public Relations  
SOUTHEASTERN MOBILE HOUSING INSTITUTE, INC.  
Suite A-1, 348 E. Paces Ferry Road, N. E.  
Atlanta, Georgia 30305

Dear Mr. Pendley:

Under a grant from the U. S. Department of Commerce, Office of State Technical Services, with matching funds from Georgia Tech, staff members of Tech's Industrial Development Division are working on a two-year project to transfer new technology to Georgia's mobile home manufacturing industry.

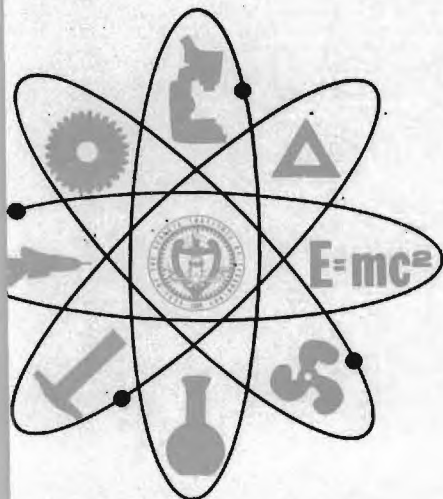
A two part seminar is planned for April 1, 1970, on the campus of Georgia Southwestern College at Americus, Georgia. The morning session will be devoted to information on enforcement of the Standard for Mobile Homes (A 119.1), with officials from Florida and Georgia presenting their state's requirements to the industry in Georgia. The afternoon session will involve a presentation, by Tech faculty members, of some of the factors to be considered in the design and construction of mobile home structural systems, with special emphasis on the chassis and floor system. There will be no charge to participants.

We will appreciate any publicity you can give this event. Additional information can be obtained by contacting the undersigned at the above address, or calling (404) 873-2931.

Yours truly, \_\_\_\_\_

Charles V. Poole, P. E.  
Project Director

CIP/tz



# TECHNOLOGY FROM TECH

INDUSTRIAL DEVELOPMENT DIVISION  
ENGINEERING EXPERIMENT STATION  
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## MOBILE HOME STRUCTURAL SEMINAR

GEORGIA SOUTHWESTERN COLLEGE

Americus, Georgia

Wednesday, April 1, 1970

### AGENDA

- 11:00 a.m. - Registration (no charge to participants) and  
Introductory Remarks. Room 106, New Classroom Building
- 12:00 noon - Lunch (Dutch Treat - \$1.50 each) Student Center  
Dining Hall
- 1:00 p.m. - Dr. D. C. Perry, School of Civil Engineering,  
Georgia Tech - Lecture and Question and Answer  
Period. Room 106, New Classroom Building
- 2:30 p.m. - Break
- 2:45 p.m. - Dr. D. A. Polychrone, School of Architecture,  
Georgia Tech - Lecture and Question and Answer  
Period. Room 106, New Classroom Building

NOTE! To avoid duplicating SEMHI's efforts, the sessions on  
Mobile Home Standards enforcement have been cancelled.

# TECHNOLOGY FROM TECH

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Under a grant from the United States Department of Commerce, Office of State Technical Services, with matching funds from Georgia Tech, staff members of Tech's Industrial Development Division are working on a two-year project to transfer new technology to the mobile homes manufacturing industry.

## A FINAL REMINDER

### MOBILE HOME STRUCTURAL SEMINAR

Georgia Southwestern College

Americus, Georgia

Wednesday, April 1st

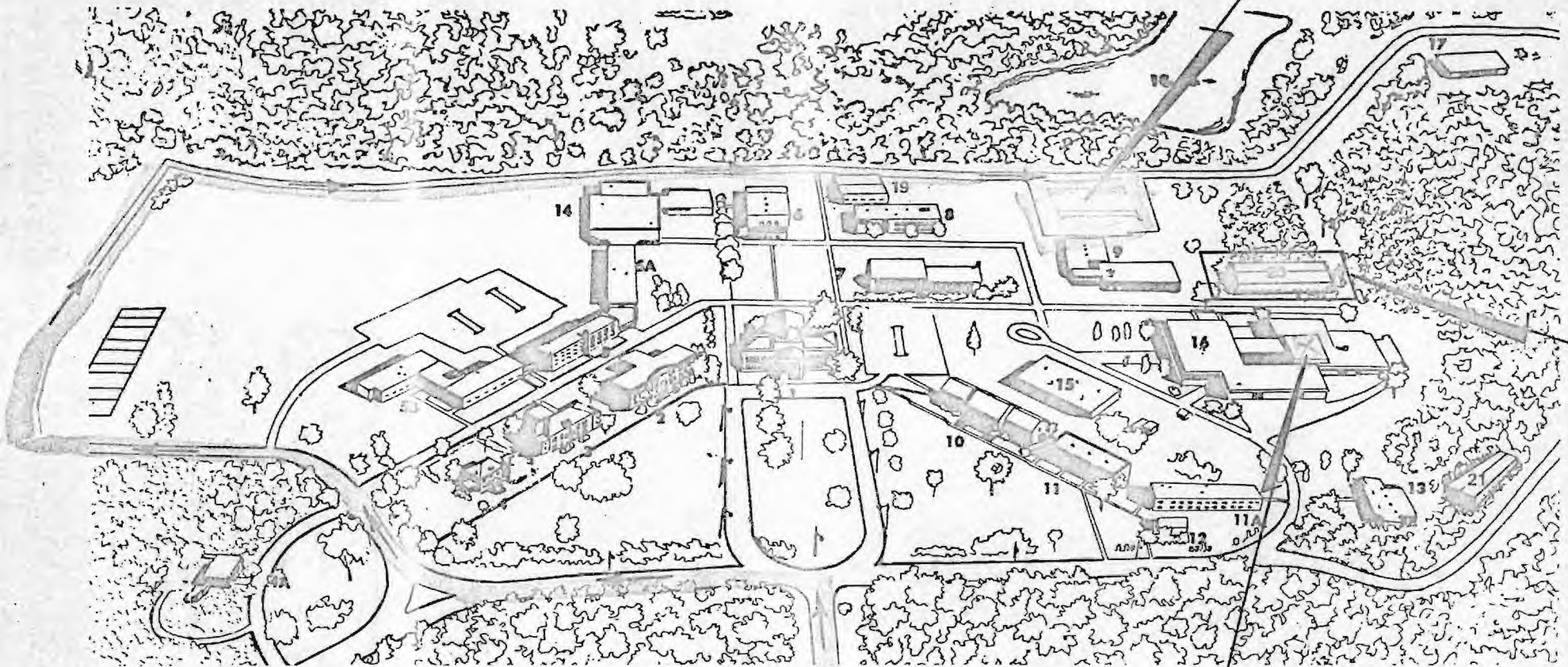
Registration begins at 11:00 a.m. in Room 106, New Classroom Building. A map of Georgia Southwestern's campus is attached showing the location of our activities. Your only cost will be your lunch -\$1.50 per person. If you can't get there any sooner, you are still welcome to make the sessions beginning at 1:00 p.m.

Dr. Perry and Dr. Polychrone's presentations are very flexible and we expect to direct their remarks toward your needs. Ample time will be reserved for questions and answers and group discussion. We encourage you to bring your questions and problems with you. Maximum benefit will be obtained if everyone will take part in the discussions.



# Georgia Southwestern College

PARKING  
AREA  
nearest  
meeting



- |                                |                             |                                 |                    |                            |
|--------------------------------|-----------------------------|---------------------------------|--------------------|----------------------------|
| 1. ADMINISTRATION BUILDING     | 5. Collum Hall (Men's Dorm) | 8. SCIENCE BUILDING             | 12. Lowery Chapel  | 17. Maintenance Shop       |
| 2. Terrell Hall (Women's Dorm) | 5a. Collum Annex            | 9. LIBRARY                      | 13. Infirmary      | 18. Lakeside Theater       |
| 3. Wheatly Hall                | 5b. Collum Annex            | 10. Sanford Hall (Women's Dorm) | 14. Field House    | 19. MOD BUILDING           |
| 4. Nursing Building            | 6. Gymnasium                | 11. Morgan Hall (Women's Dorm)  | 15. New Girls Dorm | 20. NEW CLASSROOM BUILDING |
| 4a. President's Home           | 7. JACKSON HALL             | 11a. Morgan Annex               | 16. STUDENT CENTER | 21. Women's Dormitory      |

GLENN ST

DINING  
HALL

MEET HERE ROOMS 106-107



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## BACKGROUND

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#### Plan of Procedure

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Sixth Quarter. The fifth technology transfer (Production Aids) was modified from the initial plan and the transfer completed during this quarter. An evaluation of IDD's technology transfer subjects and methodology was performed. Arrangements were completed for a series of monthly articles, utilizing technology transfer subjects where possible, to be published in a leading mobile home industry magazine.

Seventh Quarter. The seventh quarter was spent in evaluating the procedures utilized in previous technology transfers, conducting a survey of interest in a proposed seminar for the sixth technology transfer, and making the arrangements for a mobile home structural seminar to be held at Georgia Southwestern College, Americus, Georgia.

## EIGHTH QUARTER ACTIVITIES

### Sixth Technology Transfer

Quarterly Report No. 7 fully reported the preparations for the mobile home structural seminar to be held on the campus of Georgia Southwestern College at Americus, Georgia. As scheduled, the seminar was held on April 1, 1970. Registration began at 11:00 a.m. A list of the attendees is included as Appendix A. Following the registration period, the Project Director discussed this Special Merit Project. Since all of the previous transfers except transfer number four (Management by Objectives, which was mailed to all known mobile home manufacturers in Georgia) had involved only our sample, many of those present were unfamiliar with the project. IDD's field personnel were introduced and the services available from this source were outlined.

The first speaker in the afternoon was Dr. Dale C. Perry, Associate Professor of Civil Engineering at Georgia Tech. Although the floor system of a mobile home is a composite structure and must be treated as such, Dr. Perry discussed the factors that specifically relate to the chassis -- the steel portion of the composite structure. Dr. Perry pointed out that the most severe conditions were imposed on the mobile home while in transit. These dynamic loading conditions could result in nail "popping" and other evidences of stress after the mobile home was placed on site and occupied. Dr. Perry presented the advantages and disadvantages of the various steel shapes that could be used for the two main structural members of the chassis. In Dr. Perry's judgment, the rectangular box section is superior, not only because of its resistance to lateral torsional buckling, but because of its economy and ease of fabrication. While discussing stress reversal in the rear section (aft of the running gear) of the mobile home chassis, Dr. Perry suggested that those present should consider the use of a dolly under the rear end of the mobile home during transit. Although recognizing that there would be some problems related to the adoption of this technique, Dr. Perry stated the economies might make it worthwhile. A lively question and answer and discussion period followed Dr. Perry's presentation.

Dr. D. A. Polychrone, Professor of Architecture at Georgia Tech, gave a lecture and slide presentation on the wooden part of the mobile home floor system. Dr. Polychrone noted that there were a variety of beams in a mobile home structural system. He then discussed the factors involved in selecting the material for the floor -- plywood vs. particleboard. He discussed the



sizing and spacing of floor joists. Dr. Polychrone stressed that the standards which have been adopted (USAS A119.1-1969) are based on sound engineering principles and should be adhered to. His presentation was followed by a discussion period which concluded the seminar. Many complimentary remarks were made by those attending the seminar.

#### 5th Annual Southeastern Mobile Housing Show

At the invitation of John B. Manley, Jr., Executive Vice President, Southeastern Mobile Housing Institute, personnel of Georgia Tech's Industrial Development Division operated a booth in the Suppliers Building at the 5th Annual Southeastern Mobile Housing Show. This show was held at the Farmer's Market, Atlanta, Georgia, April 22 through April 26. A display was made using a modular housing concept developed by students in Georgia Tech's School of Architecture. The display included a model composed of six modules, suitable for manufacture in a mobile home plant, combined into a two-story duplex townhouse. See Appendix B for a picture of the model and a sample of the literature handed to visitors at the booth. A great deal of interest was shown in the model and the response was highly satisfactory.

#### Field Survey of Sample Companies

IDD's field personnel at Albany and Douglas, Georgia, contacted the companies who have participated in our transfer program. Using a questionnaire similar to the one in the Fourth Quarterly Report, an attempt was made to determine acceptance of the six technology transfers. The survey was made during the last two weeks of May 1970. The results of this survey are consolidated in Appendix C.



## EVALUATION

### General Background

The idea that innovations generated in the technologically oriented industries could benefit the remainder of American industry was a fundamental premise of the State Technical Services (STS) Program. During the period just prior to the establishment of the formal program, attempts to regularize the transfer machinery were tried by various state and national agencies. It soon became apparent that the best efforts of the transferring agency gave unpredictable results. Academicians had long been aware of the diffusion phenomena involved, but funds to support systematic research on them had been minimal. The enactment of the State Technical Services Act of 1965, with the intent to increase the rate of diffusion in an effort to increase the degree of acceptance, made it possible to fund studies of the transfer mechanism and its effect on diffusion.

These studies took several forms. Some spoke to the organization, training, and political placement of the transfer agency. Others examined the individual who was to attempt the transfer. Still others examined the recipient and the likelihood that he would accept and act on the information transferred.

Much of the earlier STS field work analysis concentrated on deciding when a successful technology transfer had occurred. From a cost/benefit analysis viewpoint, the first sign of recognition by the recipient that an innovation existed was accepted as proof that the transfer had occurred. Frequent claims of success resulted, but little economic growth attributable to the technology transfer occurred.

Studies conducted by Smith<sup>1/</sup> in the tool-and-die industry in Michigan indicated great resistance to innovation in an industry characterized by precision standards, sophisticated tools, and a market containing many technologically oriented customer.

---

<sup>1/</sup>Donald N. Smith, Technological Change in Michigan's Tool-and-Die Industry, Ann Arbor, Michigan, 1967.

Studies were conducted by the Institute of Applied Technology on the possibility of moderating the cycling of certain industries through the introduction of new technology. Again, variations in receptivity to innovation were noted, indicating different types of social behavior and interpersonal relations were being encountered during the diffusion of a given innovation.

This variation in the rate of diffusion also was studied by Katz, Levin, and Hamilton.<sup>1/</sup> Their study examined the variables which occurred in the interdependent system (endogenous variables) as well as the predictor (exogenous variables). They devised a set of component elements in the diffusion process which could be considered the key variables. Their process was characterized as (1) acceptance, (2) over time, (3) of some specific item idea or practice, (4) by an adapting unit, linked to, (5) some specific channels of communication, (6) to a social structure, and (7) to a given system of values or culture.

Mason and Halter,<sup>2/</sup> extending Katz, et al., noted that the effects of economic variables such as the level of production can impinge on a social structure just as the acceptance of an innovation can affect production. Therefore, production should be variable along with adoption and social structure.

Adoption was defined as sustained use of the innovation. Again, Mason and Halter reported a positive relationship between the adoption of agricultural and biological innovation and production. Innovation led to higher or increased production.

Social structure was defined by Katz, et al., as relating to the classification of individuals in terms of social influence and prestige. One aspect was that the attributes of the apparent source of the message affected the effectiveness of the message. Messages from an individual with prestige tend to carry weight. Prestige, in turn, relates to the particular position which an individual occupies within a social system.

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<sup>1/</sup> Elihu Katz, Martin L. Levin, and Herbert Hamilton, "Traditions of Research on the Diffusion of Innovation," American Sociological Review, Vol. 28, (April, 1963), pp. 237-252.

<sup>2/</sup> Robert Mason and Albert N. Halter, "The Application of a System of Simultaneous Equations to an Innovation Diffusion Model," Social Forces, December, 1968, pp. 182-195.

Mason and Halter found that those individuals high in influence or prestige tend to adopt innovations more readily than those low in these attributes, assuming that the community norms support innovation. Characteristically these individuals have more formal education; greater use of the channels of mass communication, particularly the printed work; more social contacts outside their communities; and higher incomes with commensurate life styles.

### Application

This research dealt with the determination of the effectiveness of various techniques (described under "Methods" earlier in this report) in transferring technology to the mobile home manufacturing industry. Using Galbraith's<sup>1/</sup> definition, technology was assumed to mean the systematic application of scientific or other organized knowledge to practical tasks.

The work was divided into a sequence of steps which were followed each time to determine the nature of the industrial adoption process. The term industrial adoption process used here has the meaning assigned by Ozanne and Churchill.<sup>2/</sup> This meaning refers to that set of activities and decisions through which decision makers in an industrial firm move from awareness of the industrial innovation to its final adoption or rejection.

The mobile home manufacturing industry in Georgia and North Carolina was chosen for this research because, as described by Carter and Williams,<sup>3/</sup> "it was thought to possess the degree of technical progressiveness which characterizes industries which are in the forefront of discovery in applied science and technology, quick to master new ideas and to perceive the relevance of work in neighboring fields."

In contrast, the upholstered furniture industry in North Carolina and Georgia was thought to more nearly fit Carter and William's description.

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<sup>1/</sup>John Kenneth Galbraith, The New Industrial State, Houghton Mifflin Company, Boston, 1967, p. 12.

<sup>2/</sup>Urban B. Ozanne and Gilbert A. Churchill, "Adoption Research: Information Sources in the Industrial Purchasing Decision," American Marketing Association Proceedings, Fall Conference, 1968, pp. 352-356.

<sup>3/</sup>C. F. Carter and B. R. Williams, "The Characteristics of Technically Progressive Firms," Journal of Industrial Economics, Vol. 7 (March, 1959), pp. 87-104.



of industries "which are quite uninterested in science and technology, and are perfectly content to continue with traditional methods without examining the alternatives."

Rogers<sup>1/</sup> industrial adoption model as adapted by Ozanne and Churchill showed that adoption of an industrial innovation such as those which were to be offered in this research followed a five-stage process. These stages and their relation to the adoption process are shown in Figure 1.

Preliminary steps taken by the research team before offering the innovation for adoption were as follows:

- a. Search of literature, producers' brochures, demonstrations of new products, etc.
- b. Identification of possible material for transfer.
- c. Development of data on each possible technology transfer item or material.
- d. Arrangement of the transfers for selection in descending order of likelihood of previous awareness on the part of industry.
- e. Selection of innovations for presentation.
- f. Preparation of presentation package -- flyer, samples, photographs, commercial brochures, lecture notes, etc.
- g. Timing of introduction of technology transfer innovation.

The selection of the mobile home manufacturing industry as likely to readily accept innovation was based on characteristics, as perceived by the research team, selected from those of Carter and Williams.<sup>2/</sup> They were the following:

- a. Good information sources
- b. Seeking outside standards of performance
- c. Not secretive
- d. Effective selling
- e. Ingenuity with shortages
- f. Good buildings

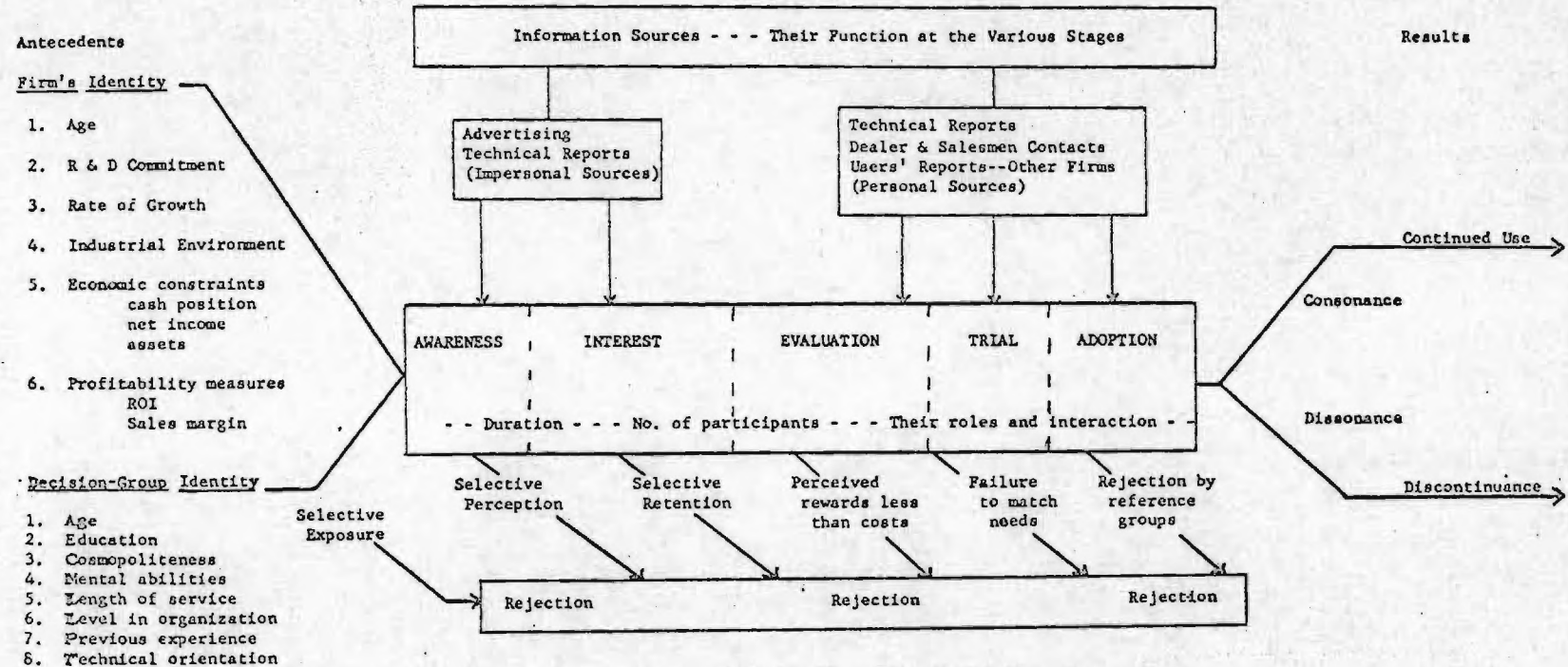
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<sup>1/</sup>Everett M. Rogers, Diffusion of Innovations, The Free Press, New York, 1962, p. 306.

<sup>2/</sup>C. F. Carter and B. R. Williams, Industry and Technical Progress, Oxford University Press, London, 1957, pp. 94-104.



# INDUSTRIAL ADOPTION PROCESS MODEL



Source: Adapted from Everett M. Rogers, Diffusion of Innovation, p. 306.

Figure 1

- g. Work floor resistance to innovation
- h. Adequate finance
- i. Good management techniques
- j. Good coordination
- k. Cost consciousness in research
- l. Good manager/chief executive
- m. Forward-looking tendency

In retrospect, this appraisal of the industry appears not to have been entirely accurate. Although personnel associated with the research project had good access to manufacturing facilities, there was very strong resistance to in-plant demonstrations or visits by competitors. Visits to more than a score of plants revealed no significant breakthroughs in production techniques, yet most plant managers expressed the feeling that their manufacturing processes were unique. Their reluctance to admit plant visitors may be explained, in part, by the burgeoning growth of the industry and the pirating of knowledgeable employees, although Danhof<sup>1/</sup> recognizes this as a time-honored method of transferring technology.

The preliminary survey of the mobile home manufacturing industry revealed a rapid expansion in the United States, with a period of accelerated growth beginning in the Southeast coincidental with the period of this research. With 25 manufacturing plants in Georgia at the inception (approximately 65 at the conclusion) to choose from, the sample size could be carefully controlled.

It was already known that certain types of innovation spread very rapidly in this industry. For example, superficial differentiation by nonessentials on the part of one firm was quickly copied by the entire industry. Conversely, the industry was aware of the undesirable image created by its adherence to shiny aluminum siding, but it continued to use this material almost exclusively.

The industry seemed to fall within the large batch or mass production mode of production as defined by Woodward,<sup>2/</sup> but many of the smaller plants (one coach or less per day) seemed more like unit or small batch production.

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<sup>1/</sup>Clarence H. Danhof, "Transferring Technology by Transferring People," Monthly Labor Review, May 1970, pp. 62-72.

<sup>2/</sup>Joan Woodward, Management and Technology, H.M.S.O., London, 1958, p. 12.

Using Woodward's scale, a firm employing unit production, or small batch production, can retain a great deal of "to-orderness" which should make it possible to create annual model changes. However, this apparently was not universally true in this instance, again perhaps because of the rapid expansion of the industry and the emergence of many small, under-capitalized firms. The industry had developed an annual styling change within the strictures of legal transportation limits, i.e., restrictions as to width, length, and height of the mobile home. Theoretically it was now possible to freeze the design, resist innovation, and mass produce the mobile homes.

The existence of many small manufacturers, each copying another and usually larger or older manufacturer's products, caused almost complete loss of product differentiation. All mobile homes looked alike. This involuntary standardization led to a resistance to change which would not be directly visible in the product.

Harvey<sup>1/</sup> discussed what constitutes a "major" versus a "minor" change in a product. He established the following criteria in terms of:

- a. whether the material used in the product is changed,
- b. whether a retooling of the production machinery is required,
- c. whether a change in the design or purpose of the product is involved.

A major change would involve a combination of (b) with either (a) or (c). By this definition the mobile home manufacturing industry seldom institutes a major change.

Harvey also assigned technical classifications based on the number of product changes occurring in the past ten years. Here, "major" product changes being considered, the mobile home manufacturing industry would be classified as "technically specific." In other words, mobile homes evolved and were free of radical departures in design, materials, or concepts. The question then became whether the industry recognized itself as receptive to new ideas or less likely to innovate. The response of the mobile home manufacturers to the question, "Are you interested in hearing about new products your firm might make?" is of at least passing interest in this regard.

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<sup>1/</sup>Edward Harvey, "Technology and the Structure of Organizations," American Sociological Review, April, 1968, pp. 247-259.



(See Quarterly Report No. 5, Appendix B, p. 10, for complete questionnaire.) Of 49 responses, 39 were affirmative, three negative, and seven did not complete the question.

Harvey also found that infrequency of product change appeared to be conducive to the establishment of stable divisions. These divisions, in turn, were the basis for further specialization and skill differentiation. Typically, change took the form of further refinement rather than simplification.

Closely related to this finding is the characteristic of having few supervisors in such a plant or company. These men have relatively unstructured jobs, while the production stations tend to have specific jobs or functions.

Firms displaying these characteristics are described by Harvey as technically specific with high structure scores. These firms usually have high ratios of routine decisions to innovative decisions. But the smaller, less structured firm with a technically specific product has the ability to make innovative decisions quicker, with less conflict and with greater likelihood of success. This is especially true when an aggressive and innovative entrepreneur controls the firm. He has the power and authority to act. Conversely, the highly compartmented firm can handle routine decisions easier than the aggressive entrepreneur who must handle all types of decisions personally. This may explain, in part, why aggressive entrepreneurs do not take advantage of all useful innovations -- they literally cannot handle the volume of decision-making required. This leads to apparently irrational conduct in a rational-appearing situation.

Diffusion of innovation has been treated by several authors, but the relevant research stressed the interpersonal relationships that might influence the adoption of the innovation. Stasch<sup>1/</sup> specified three possible relationships:

- a. Interpersonal contact with a friend who had adopted the innovation.
- b. Interpersonal contact with a professional associate who had adopted the innovation.

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<sup>1/</sup>Stanley F. Stasch, "Sample Size and Change in Simulating the Diffusion of Innovation," American Marketing Association Proceedings, Fall Conference, 1968, pp. 360-365.



- c. Interpersonal contact with an individual who had adopted the innovation and who happened to be both a friend and a professional associate.

Stasch used a sample size of 24 individuals in simulating the diffusion of innovation for the above relationships. In this research, a sample size of 19 was used similarly.

For the purpose of this research, certain assumptions were made:

- a. Some one sample firm/individual would adopt an innovation when presented.
- b. This action would be made known to other sample firms.
- c. Other firms would adopt the innovation.
- d. Other firms would reject the innovation.
- e. Reiteration -- calling back to determine decision on innovation -- would further influence acceptance of the innovation.

If the above hypothesis is accepted, it follows that:

- a. Seminars/workshops should be more effective than
- b. face-to-face confrontation, which should be more effective than
- c. a mailing of unsolicited technical or innovative material.

Figures 2, 3 and 4, which follow, summarize our sample's response to the three methods of presentation for the two technology transfers best suited to measuring this response. These statistics do not support our hypothesis. A number of factors may have been contributory. It seems probable that the statistical techniques used did not produce figures necessarily representative of the population.

### Conclusion

The area involved in this research does not lend itself to ready quantification, and the demonstration of value, in terms of dollars, is even more nebulous.

Prior to the final evaluation, and based on more subjective criteria, the research team concluded that direct personal transfer and in-plant assistance was the most effective method of transferring technology to the mobile home manufacturing industry. In spite of the findings outlined above, this is still the consensus. The use of technical representatives (tech reps) has long been a practice of more sophisticated technical industries such as the aerospace and electronic industries.

EVALUATION OF TECHNOLOGY TRANSFER							
Summary of Sample Response to Group Presentation		Gang Nail	Urethane Insulation	Teflon-S	Mgt. by Objectives	Production Aids	Structural Seminar
Action Taken by Company							
1	+ Technology implemented or being implemented	1					Reason given for not attending Seminar:
2	+ Information forwarded to company headquarters with or without feedback from headquarters		2				
3	+ Information passed to local production people with no action yet but indications technology will be tried						
4	+ None but some indication of possible future adoption		1				
5	+ Were already using transferred technology	1					
6	- Are using a similar technology and will not use transferred technology						
7	- Have used and discarded transferred technology						
8	- None; no indication of intending to adopt technology						
9	- Did not remember seeing information; someone had misplaced it; information not circulated						
10	- Will not use new technology because it						
	a. Costs too much	2					
	b. Too hard to adapt						
	c. Other	1					

Figure 2

EVALUATION OF TECHNOLOGY TRANSFER							
Summary of Sample Response to Direct Personal Transfer		Gang Nail	Urethane Insulation	Teflon-S	Mgt. by Objectives	Production Aids	Structural Seminar
Action Taken by Company							
1	+ Technology implemented or being implemented			1			
2	+ Information forwarded to company headquarters with or without feedback from headquarters						
3	+ Information passed to local production people with no action yet but indications technology will be tried						
4	+ None but some indication of possible future adoption						
5	+ Were already using transferred technology						
6	- Are using a similar technology and will not use transferred technology	1					
7	- Have used and discarded transferred technology						
8	- None; no indication of intending to adopt technology						
9	- Did not remember seeing information; someone had misplaced it; information not circulated						
10	- Will not use new technology because it						
	a. Costs too much	1					
	b. Too hard to adapt						
	c. Other			2			
Reason given for not attending Seminar:							

Figure 3



EVALUATION OF TECHNOLOGY TRANSFER							
Summary of Sample Response to Written Material		Gang Nail	Urethane Insulation	Teflon-S	Mgt. by Objectives	Production Aids	Structural Seminar
Action Taken by Company							
1	+ Technology implemented or being implemented	1		1			
2	+ Information forwarded to company headquarters with or without feedback from headquarters						
3	+ Information passed to local production people with no action yet but indications technology will be tried						
4	+ None but some indication of possible future adoption	1		1			
5	+ Were already using transferred technology						
6	- Are using a similar technology and will not use transferred technology						
7	- Have used and discarded transferred technology						
8	- None; no indication of intending to adopt technology						
9	- Did not remember seeing information; someone had misplaced it; information not circulated						
10	- Will not use new technology because it						
	a. Costs too much						
	b. Too hard to adapt						
	c. Other	2					

Reason given for not attending Seminar:

Reason given for not attending Seminar:

Figure 4



The selection of the person to make the transfer is a complex problem within itself. As initially perceived by the research team, the president of Company C was considered an industry leader. However, a test of peer leadership showed no predilection on his part to accept innovation. Although he appears to be aware of his role of opinion former, he does not seek innovation for consideration.

Because of the response generated, two of the project's technology transfers are noteworthy. Although no mobile home manufacturer has adopted urethane insulation for production models, two out of three mobile homes built for "Operation Bluesky" have urethane for insulation. As a result of publicity associated with the transfer on Teflon-S, the Project Director presented a paper, "Fluorocarbon Resin Coatings for Wood Cutting Tools," before the Mechanical Conversion Section, Forest Products Research Society, meeting in annual session at Miami Beach, Florida, June 30, 1970.

During the period covered by this project, the production of mobile homes in Georgia has more than doubled and the quality has been improved through the adoption of the Standard for Mobile Homes, USAS 119.1-1969. It is felt that project objectives were met in a timely manner.

## APPENDICES

Appendix A  
LIST OF ATTENDEES  
MOBILE HOME STRUCTURAL SEMINAR  
GEORGIA SOUTHEASTERN COLLEGE  
AMERICUS, GEORGIA  
APRIL 1, 1970

<u>Name</u>	<u>Position</u>	<u>Company</u>
Colon Kitchens	Foreman	Chickasha Mobile Homes
Wendell Knight	Production Manager	Chickasha Mobile Homes
Allen F. Baker	President	Anchor Woodcraft Corp.
W. C. Pecton, Jr.	Secretary	Anchor Woodcraft Corp.
Frank Murray		Anchor Woodcraft Corp.
C. Robert Hughes		Anchor Woodcraft Corp.
Charles F. Gilbert	Plant Engineer	Craftmade Homes, Inc.
Fred G. Key	Plant Manager	River & Horton Ind. Inc.
Allen Jernigan	Reg. Sales Manager	Philips Ind. Inc.
Larry A. Odum	Sales Representative	Clark Supply
Harold Tompkins	Plant Engineer	American Coach Co.
Norman Christophersen	Production Manager	American Coach Co.
George C. Rodriques	President	Porta-Build, Inc.
Roy Studstill	General Manager	Altair Homes, Inc.
Tom Holman	Plant Manager	Marlette Homes
Edgar Player	Plant Engineer	Marlette Homes
Art Davis	Plant Superintendent	Marlette Homes
Wayne Evans	Plant Superintendent	Bowen Homes
Bill Thacher	General Manager	Vintage Homes
Henry Barlow	Construction Engineer	Vintage Homes
Tom Hoogerhyde	Engineer	Design Homes
G. L. Brooks, Jr.	Construction Engineer	
Jerry Andrews	General Manager	Beaver Enterprises
Karl Boatright	Industrial Engineer	Detroit Mobile Homes
Nelson Schlosser	Ch. Production Engineer	Boise Cascade Mob. Homes
Wilbur Boltz	Production Engineer	Boise Cascade Mob. Homes
Murray Ellis	Assistant Manager	Champion Mobile Homes
Larry Cleghorn	Plant Superintendent	Souvenir Mobile Homes
Charles F. Bowman	General Manager	Souvenir Mobile Homes

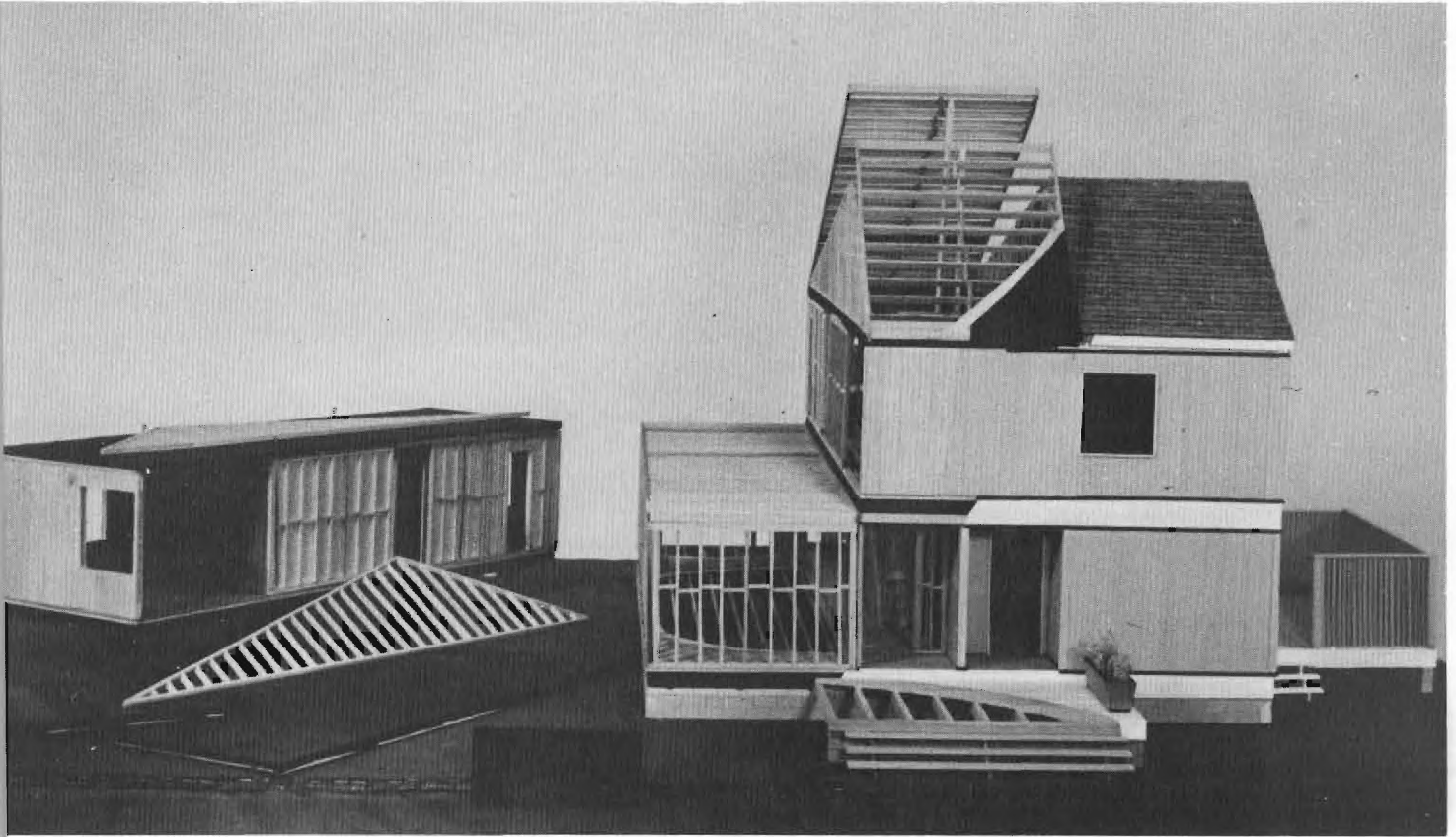
Appendix A (continued)

<u>Name</u>	<u>Position</u>	<u>Company</u>
Bill Studstill	Research Engineer	Georgia Tech
Eric Newsom	Research Scientist	Georgia Tech
Tom Murphy	Research Scientist	Georgia Tech
Dale Perry	Professor	Georgia Tech
Jim Polychrone	Professor	Georgia Tech
Frank Clarke	Sr. Research Scientist	Georgia Tech
Miles Greer	Asst. Research Scientist	Georgia Tech
Jim Holland	Industrial Coordinator	Moultrie Tech
G. A. Pitalo	Asst. Research Engineer	Georgia Tech
Charles I. Poole	Research Engineer	Georgia Tech



# TECHNOLOGY FROM TECH

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### GEORGIA TECH PRESENTS ONE CONCEPT OF A HOME:

- designed by an architect working with an engineer to take advantage of new materials and techniques.
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- erected on your lot, customized to your taste by local craftsmen.
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- excellent quality - meets FHA Minimum Property Standards, with special features to be FHA approved.

COULD YOU SUGGEST IMPROVEMENTS IN THIS DESIGN ?

Write to:                   HOUSING RESOURCES PROGRAM  
                                  INDUSTRIAL DEVELOPMENT DIVISION  
                                  GEORGIA INSTITUTE OF TECHNOLOGY  
                                  1132 WEST PEACHTREE STREET  
                                  ATLANTA, GEORGIA 30309

EVALUATION OF TECHNOLOGY TRANSFER							
Field Survey Summary		Gang Nail 1/	Urethane Insulation	Teflon-S	Mgt. by Objectives	Production Aids	Structural Seminar
Action Taken by Company							
1	+ Technology implemented or being implemented	4		2	7	1	1
2	+ Information forwarded to company headquarters with or without feedback from headquarters			2			
3	+ Information passed to local production people with no action yet but indications technology will be tried			1		1	1
4	+ None but some indication of possible future adoption	1		3		1	
5	+ Were already using transferred technology	4			2	1	
6	- Are using a similar technology and will not use transferred technology	1		3	2	4	2
7	- Have used and discarded transferred technology			1		1	
8	- None; no indication of intending to adopt technology			3	1	4	
9	- Did not remember seeing information; someone had misplaced it; information not circulated				6	3	3
10	- Will not use new technology because it						
	a. Costs too much	3	9				
	b. Too hard to adapt		9				
	c. Other	4		3			2
							Reason given for not attending Seminar:
							9

1/ Only 18 firms in sample for this transfer.

NOTE: One firm in sample bankrupt at time of survey.

## APPENDIX I

### PLAN OF PROCEDURE

#### SPECIAL MERIT PROJECT B-343

August 1, 1968

#### BACKGROUND

Project B-343 was started on July 1, 1968, and during the first month, a plan of procedure was developed within the Industrial Development Division (IDD). Various aspects of procedure were discussed with project personnel at North Carolina State University, Industrial Extension Service (IES) and with IDD field personnel.

This Plan of Procedure has been divided into three phases covering the first year of the project, and a short section which discusses the procedure to be used during the second year. As pointed out in later paragraphs, detailed procedures for the second year will depend heavily on results obtained during the first year.

During this initial planning period, North Carolina State personnel explained the project to the Southern Furniture Manufactueres' Association, and IDD personnel explained it to the Southeastern Mobile Housing Institute. The industry associations were receptive to the aims of the project, and we expect continued cooperation from both.

A project plan (schedule) was prepared and is included as a part of this Plan of Procedure (see last page).

Throughout the entire project, bi-weekly meetings will be conducted with the staff of IDD's Technical Services Section, and continuous coordination will be maintained with North Carolina State's Project Director. Also, we have prepared a project "data input sheet" which explains the objectives of the project and identifies data inputs we would like to

August 1, 1968

receive from Georgia Tech personnel who are not directly assigned to the project. These sheets will be distributed to faculty members and others whom we feel are in a position to contribute to the success of the project.

#### PHASE I

Phase I will consist of work performed during the first month of the project, and will also include: (1) Selection of "contact" companies (that small group of companies with whom our "in depth" study will be conducted); (2) participation in the SEMHI's first annual convention; (3) preparation of guidelines for IDD Field Personnel; (4) a search for new technology appropriate to the industries involved, and also appropriate to the objectives of the project; (5) personal visits to the contact companies to explain the project; (6) selection of the first new technology to be transferred; and (7) coordination of the first new technology transfer with North Carolina State.

It is expected that we will select within the state of Georgia, approximately 20 companies from the mobile homes industry, and 6 companies from the upholstered furniture industry as IDD contact companies. These groups will undoubtedly vary in numbers throughout the initial phase of the project. However, we will attempt to solidify both groups prior to the beginning of Phase II.

As an indication of the cooperation anticipated from the industry associations, we have been invited to attend the first SEMHI convention at Jekyll Island on August 13, 14 and 15. We feel fortunate that this event will take place at mid-point in Phase I, the point at which we will be completing our selection of contact companies and looking for target areas for our first technology transfer. The Head of IDD's Technical Services Section, and the project director will attend.

A set of guidelines will be prepared for use by IDD field personnel. The purpose of these guidelines will be to insure that the three selected transfer techniques are performed similarly by each field office. The three techniques are briefly described in the Special Merit Grant, but

Plan of Procedure cont'



August 1, 1968

will need to be more detailed as to methods of application. Although we will initially attempt to establish a set of guidelines for use throughout the project, it may be necessary to revise these for each new technology transfer.

The project director will accompany the Head of the IDD field office on the first visit to each contact company to assist in presenting the project objectives. Every precaution will be taken during these visits to keep the companies from feeling they are being used as "guinea pigs" for an experiment. Such terminology as "regressive industry", techniques of technology transfer", "contrasting industries", etc. will not be used during the initial, or subsequent, company visits. At the same time, positive values to be gained by the companies will be emphasized.

Throughout Phase I, a continuing search will be conducted to find a "simple" new technology that will be appropriate for our first transfer effort. As an example, North Carolina State personnel have discovered a new dowel pin design which uses 13 parallel, V-shaped grooves running the entire length of the dowel. This design is opposed to the spiral grooves traditionally seen on dowel pins. The new dowel reportedly reduces glue wiping action as the dowel is inserted, and gives a stronger joint.

The North Carolina State project director proposes to use this item (including sample dowels) for his first technology transfer to the upholstered furniture manufacturers. He will also forward all pertinent data to IDD for transfer to the Georgia furniture manufacturing contact companies.

When suitable technology has been selected for IDD's first transfer, a joint meeting will be conducted with North Carolina State personnel to coordinate a simultaneous transfer. This means that North Carolina State must have selected their North Carolina mobile homes contact companies and be ready to transfer technology to that group by the beginning of IDD's Phase II (Oct. 1, 1968). We, at IDD, will reciprocate by selecting our group of furniture manufacturing contact companies early in Phase I.

Plan of procedure cont'

August 1, 1968

PHASE II

At the completion of Phase I, IDD field personnel (with assistance of the project director as required) will transfer the first technology to their respective companies. An attempt will be made to have our group of companies equally divided between the Albany and Douglas field offices, and to have a group that is divisible by "3", since we will be using three transfer techniques.

Each field office will use all three techniques to transfer the first technology. These are: (1) Group Presentations, (2) Transfer by Written Materials, and (3) Direct Personal Transfer and In-Plant Assistance. As an example, if there are nine contact companies in the Albany area, transfer technique (1) will be used with three companies; technique (2) with another three, and technique (3) with the remaining three companies. However, the technology being transferred will be the same for all companies provided they are all mobile homes manufacturers.

Since a few of the contact companies will be suppliers (doors, windows, roofs, etc.) to the mobile homes manufacturers, it will be necessary, in most instances, to use a different technology with these companies. However, we will always attempt to apply all three techniques to each bit of technology transferred throughout Phase II.

IDD field personnel will continually monitor all companies by personal visits, written communications, telephone calls, and any other means, throughout the transfer period. All information obtained will be forwarded to the project director along with pertinent suggestions and interpretations. At some point during this transmittal of information, the project director and field personnel will agree that the transfer period should be considered closed for the purpose of beginning a data analysis preparatory to starting transfer of another bit of technology. Any information obtained after the "cut-off" point, will be held for subsequent analysis.

Plan of procedure cont'

August 1, 1968

After the results of the first technology transfer have been evaluated, a second transfer will be effected in the same manner as the first. At this point we will know if it is necessary to revise the guidelines established prior to the first transfer.

The technology selected for the second transfer will be a more "difficult" type, i.e., harder to "sell", but still offering equal or greater benefit. The reasons for selecting a more difficult technique are threefold: (1) we will have gained experience in technology transfer at a "lower" level without having much to gain by repetition; (2) the benefits derived by the contact companies should be sufficiently greater, thereby rejuvenating their interest in the project; and (3) we will have a new set of data that we can combine with the first transfer data to plan Phase III.

After the conclusion of each transfer in Phase II, and subsequent to the data analysis periods shown on the Project Plan, an oral presentation will be given to interested IDD staff members. These presentations will be intended primarily to generate an interest in the project from IDD personnel not directly assigned to the project. Through this source of knowledge we expect to receive constructive criticism, suggestions, ideas for new technology, and other aids that will enable us to do the best possible job on this project.

Immediately following the oral presentation, all pertinent data will be released to the entire mobile homes industry. If possible, this will be accomplished by release through the state and regional association.

### PHASE III

During the early part of Phase III, a composite study of results obtained from the first two transfers will be performed, to determine if any one transfer technique appears to offer advantages over the other two. It is quite possible that two techniques used simultaneously may prove to be more advantageous. However, for our initial planning, we will assume that one technique evolves from this study.

Plan of procedure cont'

August 1, 1968

When the best transfer technique has been determined, it will be used to transfer an advanced technology that has been selected on the basis of being more "difficult" than that selected for our second transfer.

The results of this transfer will then be analyzed and included in an IDD oral presentation that will cover the entire first year's progress. After "dressing up" the presentation through comments and suggestions from the IDD staff, the presentation will be repeated at North Carolina State in July, 1969. Hopefully, North Carolina State will make a similar presentation at Ga. Tech.

Again, all pertinent information will be released to the mobile homes industry.

#### SECOND YEAR (July 1, 1969-June 30, 1970)

The first nine months of our second year will consist primarily of repeating Phases II and III, and continuing our analysis of all data. The details of how we proceed during this repetition period will be largely dependent upon the results obtained at the end of the first year.

The last three months of the project will be devoted entirely to data analysis and report preparation.

#### REPORTS

Project directors in both states have agreed to exchange monthly reports throughout the project, except during those months when quarterly reports must be prepared for OSTS.

The monthly reports prepared at IDD will also be distributed to a controlled list of IDD personnel. This control will be necessary to insure that no reports reach personnel in the two industries involved.

Quarterly reports will be prepared for OSTS under terms of the Grant. The first quarterly report will be submitted by Oct. 31, 1968. A rough

Plan of procedure cont'



August 1, 1968

draft of each quarterly report will be submitted to appropriate IDD staff members for approval. These rough draft reports will also be coordinated between the project directors in each state.

At the conclusion of the project, a comprehensive report will be prepared jointly by North Carolina State and IDD at Georgia Tech.

## APPENDIX II



ENGINEERING EXPERIMENT STATION

# GEORGIA INSTITUTE of TECHNOLOGY

Industrial Development Division

1132 W. Peachtree Street  
Atlanta, Georgia 30309  
873-2931 Area Code 404

### TRIP REPORT

#### First Annual Convention

Southeastern Mobile Housing Institute

Jekyll Island, Georgia August 13-15, 1968

by: Frank J. Clarke & Harry L. Stiltz

The first annual convention of SEMHI was attended by Frank Clarke, Head of the Technical Services Branch of Georgia Tech's Industrial Development Division, and Harry Stiltz, Project Director of the Special Merit project involving technology transfer to the mobile homes industry. We were invited to attend this convention by Mr. John Manley, Executive Director of SEMHI who also invited us to speak to the assembly. Our purpose in attending was threefold: (1) to speak to the general assembly and acquaint them with the special merit project while simultaneously explaining the overall function of the Technical Services Branch, (2) to learn first-hand the type and source of problems within the industry, and (3) to meet as many top level management personnel as possible. We feel that our attendance resulted in an appreciation of our project objectives by top management and that we can expect close cooperation from them throughout the project. We also have an insight into the problem areas within the industry, and we propose to select these as target areas for our technology transfer effort.

SEMHI is a regional association providing services for six southeastern state associations consisting of the Alabama Manufactured Housing Institute, Georgia Mobile Home Association, Mississippi Mobile Home Association, North Carolina Mobile Housing Institute, Mobile Housing Institute of South Carolina and Tennessee Mobile Housing Institute. Since our project is only concerned with those companies located in Georgia and North Carolina, we devoted most of our time to these groups. However, we advised the general assembly that upon successful transfer of technology within these states, all data concerning that technology will be made available to the entire industry.

All individual state association meetings were conducted at the same time, so we attended the Georgia meeting. Although we met several people who will be helpful in the project, the meeting was generally devoted to association business and didn't add appreciably to our objectives.

At the conclusion of the state meetings, which lasted several hours, all subsequent business was conducted as a joint effort in a general assembly. The first assembly was devoted to defining problem areas within the industry and discussing these problems in general terms. Then the assembly was divided into groups, with each group assigned a problem area for more detailed discussion. Hopefully the group discussions would result in possible solutions that could be presented to the general assembly for consideration. Mr. Clarke attended the manufacturer's group meeting and Mr. Stiltz attended the supplier's meeting.

At the supplier's meeting, "inadequate insulation" was discussed in depth. It appears that the new Mobile Homes Manufacturers' Association (MHMA) Manufacturing Standards (All9) contain specifications which consider mobile home heating, but not air conditioning. As an example, heating duct sizes are specified in the standards, but these sizes are too small for adequate air conditioning. This is probably an outgrowth of the feelings expressed by many manufacturers that only 3% of their mobile homes are equipped with air conditioning at the time of manufacture. However, it was learned from the dealers that approximately 75% of the homes sold by them are air conditioned. This means that the dealer is faced with the problem of installing air conditioning (and guaranteeing the installation) in mobile homes that are not properly designed for air conditioning. One dealer stated that he installed an air conditioning system in a unit, and subsequently had to replace all ductwork at a cost of \$450.00 which he has been unable to collect from the manufacturer. Conversely, one manufacturer stated that he didn't want to go to the expense of installing additional insulation "with the assumption that the unit might someday be air conditioned." Although this problem must be resolved between the manufacturers and dealers, the general subject of insulation should be investigated during the technology transfer project.

Representatives of the Foremost Insurance Company expressed concern that insulation presently used around flues in mobile homes is inadequate from a fire hazard standpoint. They stated that statistics showed the majority of mobile home fires originate in this area. Mr. Stiltz met with one of the representatives after the meeting to discuss this subject in more detail. The representative stated that prior to the advent of the "double wide" (24 feet) mobile home, the flat roof was approximately 4 inches thick and consisted mostly of insulation which completely surrounded the flue. However, the double-wide units have pitched roofs with a space of approximately 12 inches between ceiling and roof. This area in many units is not adequately insulated and consequently

exposes the flue to highly flammable materials. Although it doesn't require new technology to convince a manufacturer that he should insulate flues, the use of "highly flammable" materials in mobile homes does require consideration. The recent Apollo spacecraft fire and the resulting search for new non-flammable materials is a dramatic example of what can happen and what steps should be taken to prevent such a catastrophe.

The manufacturers group met to review progress being made towards uniform standards which would permit their units to be acceptable in all southeastern states. It was agreed that minimum standards which could be provided within each price range were needed. At present, economics used in manufacture by some companies to meet prices, preclude the addition of electric appliances or air conditioning by the owner without rewiring, new duct work or both. This policy was defended by some companies while others felt that the industry should upgrade its image and build for families who planned to live permanently in a mobile home.

The power companies are moving steadily towards an agreement as to what qualifies a unit for the all-electric power rate concession. For example, thirty gallon water heaters will be standard in all states soon. Similarly, the power companies are moving toward uniform insulation requirements. The Georgia Power representative urged particular care in the use of aluminum wire in place of costly and scarce copper wire. Aluminum is less flexible and special fittings are essential if code requirements are to be met.

The power companies also feel that as the emphasis on modular housing rather than mobile homes increases, the standards for conventional housing will prevail. This will permit standardization to a greater extent and permit the use of larger water heaters, for example, without increasing the overall cost of the home.

The insurers and other companies interested in the relative permanency of the proposed modular houses met separately later Tuesday afternoon. During this discussion it was agreed that the companies must become familiar with the problem of insuring these units as multiple dwellings. The discussion emphasized this point, but it was also realized that many single family modules would be created and these created a new risk group about which little was known. Mr. Clarke pointed out that it seemed unlikely that the federal government would accept lack of experience as the bias for not insuring these homes. It was agreed to meet again at Georgia Tech to discuss ways to cope with this problem.

Mr. Roy Briggs, Project Director at North Carolina State University will be pleased to know that we met several times with Mr. Doyle Smith, Executive Director of the North Carolina Mobile Housing Institute. Mr. Smith was enthusiastic about the objectives of the project and assured us that he



would cooperate to the fullest extent possible. The NCMHI office is located in Raleigh and is a new office. Prior to establishing this office, North Carolina and South Carolina were operating jointly as the Mobile Home Association of the Carolinas. Mr. Clarke also discussed the role of Georgia Tech's Industrial Development Division and North Carolina State's Industrial Extension Service with Mr. Smith. He is anxious to obtain these services and will contact Mr. John Hart at North Carolina State for further details.

The problem of interesting young men in careers in the industry were discussed on Thursday morning. Very little has been offered by the colleges which is suited to the industry's needs. There is a need for architectural and design work, seminars on technical and business techniques, etc. Georgia Tech plans to assist SEMHI in this area too.

Mr. Clarke and Mr. Stiltz both spoke to the general assembly during the Thursday morning session. Mr. Clarke discussed Industrial Development Division's State Technical Services activities and then introduced Mr. Stiltz who discussed the special merit project. Mr. Stiltz advised the group that he would be visiting some mobile home manufacturers in the near future to discuss the project in more detail, and asked that top management make every effort to meet with him on the initial visit. The response to this request was better than anticipated since several manufacturers contacted Mr. Stiltz after the meeting and requested that he visit their plants. Mr. William Snyder, publisher and editor of the "Southeastern Mobile News", obtained photographs during our presentations and advised us that he would publicize the project in the next issue of the news.

Mr. Robert M. O'Mahoney, Assistant Chief Counsel of the Federal Highway Administration spoke to the assembly on the subject of regulations relating to the movement of mobile homes on interstate highways. This discussion did not add much to our realm of interest, but did cause us to wonder why mobile homes are not moved by rail.

Mr. Charles A. Dieman, Assistant Director of Technical Affairs for the Federal Housing Administration spoke to the assembly on the FHA's role in community development using the "modular" home approach. He showed slides of homes in the Ashburn, Georgia development, and we were quite impressed with the similarity of these modular units to conventional housing. He advised that FHA will not insure mortgages on mobile homes,

but will on modular homes. His definition of a modular home was one "without axles and wheels, and reasonably attached to the site". He also stated that they were looking for units that depart radically from the normal mobile home design, i.e., no shiny aluminum siding, no rectangular box appearance, etc. Mr. Dieman also pointed out that FHA would allow furniture and appliances to be included in modular home mortgages, whereas they will not in a conventional home. He pointed out quite strongly that the mobile home industry must undergo a radical transition in design before it can expect to obtain community acceptance.

Mr. Dieman has arranged six demonstration projects where radical innovations to provide housing will be tested. One of these at Millen, Georgia will concern a participant in the special merit project. The size and type of units was not available.

Four categories of FHA are involved in the new programs:

Ultra Low Cost Housing	Under \$ 4,000
Very Low Cost Housing	4 - 10,000
Low Cost Housing	10 - 20,000
Moderate Cost Housing	20,000 up

Similar programs exist under the Farm Home Administration for rural areas.

Rental housing, particularly non-profit types or for the elderly, are being encouraged by FHA and HUD.

Prior to Mr. Dieman's presentation, Mr. James W. Henley, Jr., Atlanta Housing Authority, had offered bid documents to the manufacturers for 60 "relocatable" (modular) homes for the Bedford-Pine Urban Renewal Project. We were shocked to note that only a few manufacturers availed themselves of the opportunity to bid on these homes. However, during subsequent private conversations with several manufacturers, it appeared that many of them just hadn't quite grasped the import of the "modular" home discussions by Mr. Henley and Mr. Dieman. It appears that the smaller manufacturers are reluctant to depart from their mobile home activities to enter the modular home market. This is an interesting instance of "incomplete transfer", since Mr. Henley (with ready cash to spend) and Mr. Dieman (with mortgage insurance and technical assistance to offer) were unable to convince the smaller manufacturers that they should enter the modular home field, while at the same time, the two largest mobile home manufacturers are battling each other furiously for the first modular homes orders. Could part of the reason be attributed to such frightening

statements as; "we will not accept shiny aluminum siding," "we need a radical departure in design," "you must manufacture these units at this price," "the government will not tolerate. . . .", "the specifications merely state that if you hit the side wall with a baseball traveling at 40 miles per hour, the wall shall not show any visible signs of deformation," etc. We think this could have some bearing on the small manufacturer's apparent apathy. It was also inferred that the manufacturers consider hiring politicians to do their marketing as one of the larger manufacturers recently did (and by so doing, took a large order away from a company who thought they had the order in the bag). This inference must certainly frighten a manufacturer who has heretofore sold his products directly to a dealer for resale. It immediately presents the problem of setting up a new marketing group and thereby possibly alienating the affections of the dealer who must of necessity be by-passed in this new market.

At the conclusion of the convention, we learned that the president of SEMHI met with most manufacturers privately and talked approximately 15 of them into paying the required \$10.00 deposit for bid documents. It will be interesting to see how many of these manufacturers actually submit bids. The \$10.00 fee cannot be considered as a deterrent since it will be returned after the bid opening.

This discussion of "incomplete transfer" is intended to present "food for thought" for those of us on the technology transfer project. When we see a transfer fail, it behooves us to investigate the "whys".

Our attendance at the convention was well worth the time and expense. It would have been much more costly and time consuming to gather this amount of information from literature and individual plant visitations.

We should also note that the convention was addressed by Governor Lester Maddox and Senator Herman Talmadge, neither of whom contributed information relative to technology transfer.

The 1969 SEMHI convention will be held in Mobile, Alabama, and we will determine the extent of our participation on the requirements of the project at that time.

## APPENDIX III

### TRIP REPORT

#### Performance of Buildings Conference

National Bureau of Standards - Gaithersburg, Md.

September 23-25, 1968

By: Harry L. Stiltz

Mr. John P. Eberhard, Dean of SUNY at Buffalo, during his opening remarks, expressed his disappointment that this conference was not attended by more architects, engineers and building superintendents. (A look at the list of Registrants shows that most registrants were from the building supplier industry.) He expressed a need for building standards that would provide factory sized components as a means of reducing "on site" skilled labor requirements, and then asked, "Why do we continue to build homes with 2 x 4's spaced 16 inches on center?"

In keeping with Mr. Eberhard's discussion, Mr. B. E. Foster, a consultant in the NBS Building Research Division, also advocated a need for building standards. He stated that about one-half of the building industry is composed of suppliers manufacturing to precise quality control standards, and the other half is composed of builders who alter and then assemble these components without standards. Mr. Foster expressed an opinion that a set of standards for buildings that restrict alteration of components at the assembly site, would necessitate factory assembly.

In keeping with this thought, Mr. Neal B. Mitchell, President of Neal Mitchell Associates and a Professor of Architectural Engineering at Harvard, showed slides of a new modular housing design that he recently introduced as a HUD project in Detroit. He classifies these as "self-help" modules in that they can be assembled in "building block" fashion on-site with inexperienced labor. Practically all components of these modules are bolted together and supported by a column and beam framing of cellular concrete construction.

NBS has just completed an exhaustive performance test of Mr. Mitchell's design by assembling a complete unit at Gaithersburg and subjecting it to many tests. The results of all tests exceeded design specifications except wind load tests with all interior walls removed. It was found that much of the horizontal strength was due to the bolted-in-place interior walls, and as a result of this discovery, all drawings for the Detroit project contained a notation that interior walls could not be removed simultaneously. This appeared to be an important limitation, although a Detroit official who was present stated that this could readily be controlled through the Building Permit Office. He said that anyone in Detroit who wanted to alter a building would have to obtain a building permit and at that time all drawings of the building would be studied before a



permit was issued. Needless to say, there was much private discussion on this point between sessions.

Many of the remainder of the sessions were devoted to discussions by NBS personnel concerning methods used to test the Mitchell modules. Also included were discussions of tests performed for FHA on four types of wall construction. Mr. H. E. Robinson, Mechanical Engineer, NBS, expounded at great length about the quality of the test chambers he used during the wall tests, and indicated that much of the quality could be attributed to the "foamed-in-place" wall construction he had used. When I reminded him of those statements and then asked why such a wall was not included as a test specimen, he "passed the buck" to the FHA who did not have a representative present. Since we have considered this type of wall construction as new technology for the mobile home industry I will attempt to find out from FHA why they have not considered it in their experimentation.

In addition to the wall tests, NBS has also been active in testing sanitary plumbing fixtures and flooring. These tests were described in great detail, but results of the tests were rather meager. As an example, a fiberglass bath tub shows cigarette burn stains more than cast iron, steel, and other types; fiberglass tubs filled with water maintained at 200° F for 24 hours showed a slight tendency to peel; polished stainless steel tubs show scratches much more than other types; water drains more rapidly from a tub that is slightly recessed than from a flat bottomed tub (due to film flow action); etc.

It is this writer's opinion that NBS is taking an active role in assisting FHA, HUD and other government agencies with their present housing problems. However, "systems" testing of buildings is a new effort for that agency and is just now reaching the "testing criteria" stage. It is apparent that a better performance criteria based on "user needs" is required before laboratory tests of the type described can impart any appreciable useable data to the building industry.

If it were not for the personal contacts I made between sessions and the fact that IDD is vitally interested in all phases of the residential building industry, I would feel that much time was wasted in attending this conference in-so-far as our Special Merit Project is concerned. However, details learned at the conference will be shared with other members of the STS Branch as time permits and perhaps as a group effort, we can contribute to the National Housing Goal (as expressed by Mr. B. T. Braun, Director, Low Income Housing Demonstration Program, HUD) of 26,000,000 housing units during the next ten years. Since this is a ten-fold increase over

Trip Report  
Gaithersburg, Md.

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Sept. 30, 1968

our present building rate, assistance in reaching that goal must of necessity come from many organizations not previously involved in the building industry. Keeping this thought in mind, and forgetting for the moment the objectives of our Special Merit Project, much useful information was obtained at the conference.

A special feature service published by the Georgia Institute of Technology • Atlanta

# Science and Technology / TODAY #194

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August 1, 1968

ATLANTA, GA.: A Georgia industry that last year provided housing for 32,000 families is the target of a unique research project underway at Georgia Tech.

Staff members of Tech's Industrial Development Division, armed with a two-year, \$125,000 grant, are initiating a transfer of engineering technology to Georgia's mobile housing industry.

The project is entitled "A Demonstration of the Application of Technology Transfer Techniques to Two Regional Industries." The Industrial Extension Service at North Carolina State University will undertake the same technology transfer with the upholstered furniture industry in North Carolina.

Funded by the Office of State Technical Services of the U. S. Department of Commerce, the study has as its purpose to identify new technology particularly appropriate to the two industries and effectuate the transfer of that technology by various techniques. Matching funds for the study were provided by Tech and North Carolina State. As technology is developed for each industry it will be exchanged between the two states.

(more)

Georgia is the second largest manufacturer of mobile homes in the nation. Last year in the state, over 40 manufacturers paid workers salaries that exceeded \$15 million.

Present in the southeastern region of the United States economy is a growing segment of emerging industries," said Frank Clarke, Head of Technical Services Section of IDD. "The mobile housing industry is a highly innovative one. We want to accelerate this rate of innovation." The government has spent millions of dollars on research and development in learning and applying new techniques to existing projects, for instance, in the space industry," said Harry J. Stiltz, Tech's project director.

We want to tap this vast reservoir of knowledge within the government and apply it to state and regional industries," he added.

Field personnel in Tech's Industrial Development Division will contact a group of mobile home manufacturers in the state. An explanation of the program will be made and new techniques applicable to the industry will be made available on an individual basis, according to Stiltz. New manufacturing techniques will be disseminated to the mobile home manufacturers through personal discussions, seminars and publications. The Tech project is being conducted in cooperation with the Southeastern Mobile Housing Institute headquartered in Atlanta.

In Georgia there is a great need for low-cost housing in small communities," Clarke pointed out. "This need has brought about a concept known as 'instant housing'. The public's acceptance of mobile housing is increasing."

(more)



Stiltz sees the project as involvement in a social problem. "We're helping the urban and rural areas in the state simultaneously," he added.

George Alexander, president of the Southeastern Mobile Housing Institute, is a supporter of the Tech project. "The industry welcomes outside agencies taking a look at our industry with the ultimate in mind of improving fabrication techniques and quality components in order to make our product available to the buying public at the lowest possible cost," he asserted.

## The Atlanta Journal

Covers D.C. Like the Post

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### THE ATLANTA CONSTITUTION

The South's Standard Newspaper



#### Credit Assets Rise

Assets in credit bureaus in Georgia chartered by the Bureau of Federal Credit Unions rose 13 per cent over 1966 to \$99,472,000 last year, according to Robert P. Bynum, regional commissioner here of the Social Security Administration. That figure was a new high, as were member savings of \$86,975,000 and loans of \$76,069,000, said Mr. Bynum whose agency is the parent of the Credit Union Bureau. Membership in the 231 credit unions in the state was 181,045, up 8.3 per cent. Credit unions are private organizations of individuals with occupational, associational or residential ties which promote savings by members as a source of loans. Nationally, assets of 12,210 federally chartered credit unions grew 9.5 per cent to more than \$6.2 billion in 1967.

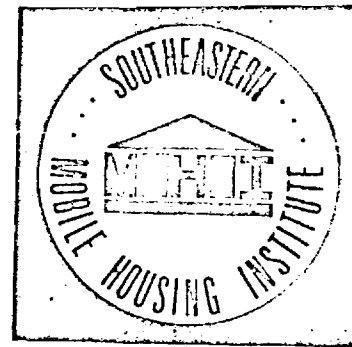
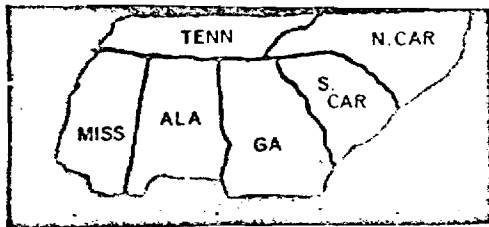
#### Tech Gets Big Grant

Georgia Tech has received a \$125,000 grant for an unusual two-year research project through which its Industrial Development Division will undertake to transfer technol-

ogy between the Georgia mobile home industry and the upholstered furniture industry in North Carolina. North Carolina State University will participate in the project which is aimed at increasing the rate of development and innovation in each technology. Georgia's mobile home industry, the nation's second largest with 40 manufacturers and payrolls exceeding \$15 million, last year provided housing for 32,000 families. The industry is regarded as a potential resource for solving many of the nation's housing problems.

#### New Headquarters

Southern Federal Savings and Loan Association is formally opening its new headquarters at 712 W. Peachtree St. NW through Wednesday of this week. A number of activities are planned, according to Frank L. Conner, president, who noted that the building has two drive-in windows and parking for 49 cars. The 32-year-old institution has assets of about \$30 million and reserves and undivided profits of \$3.5 million.



## Tech Announces Joint Research Study

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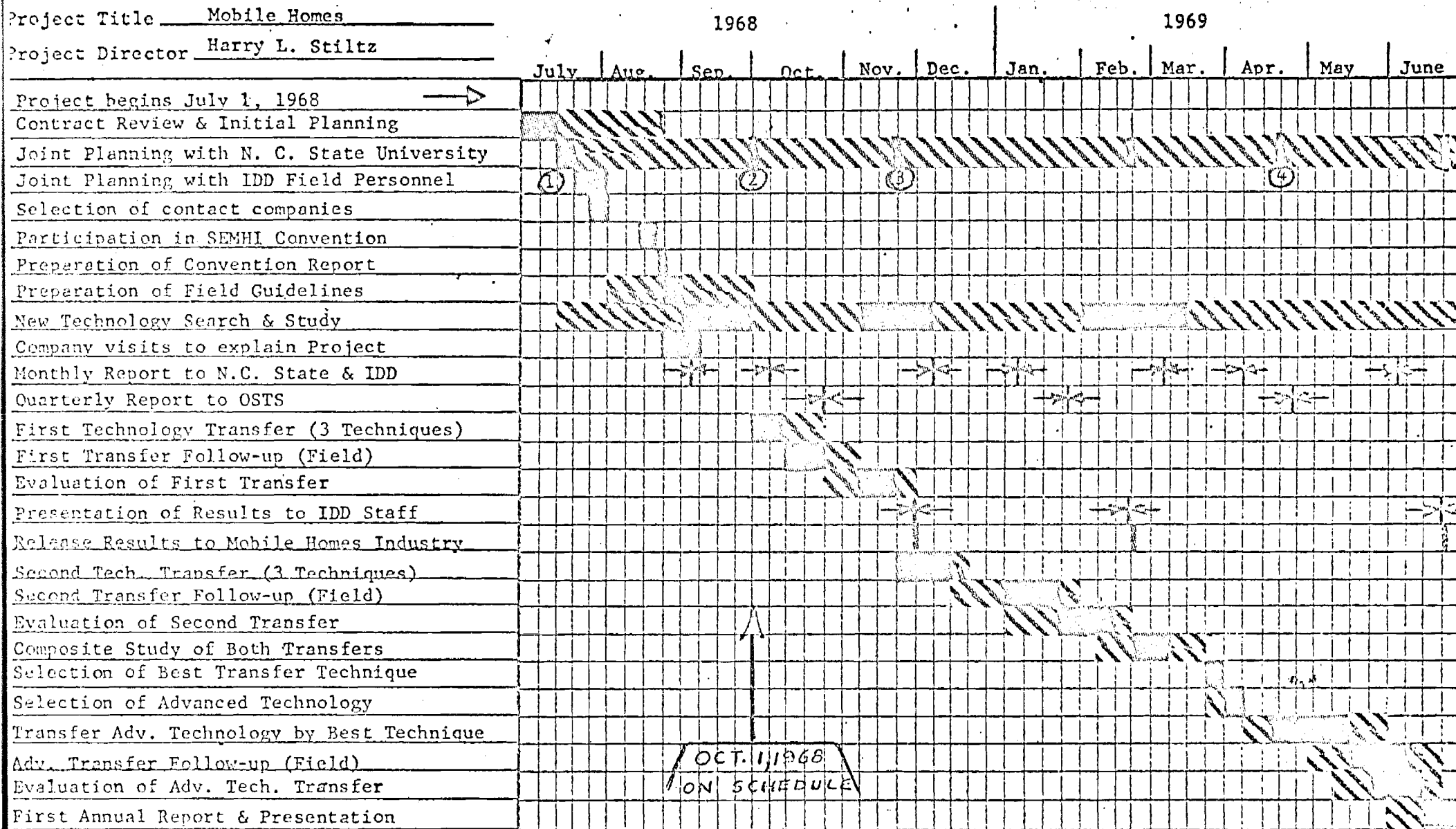
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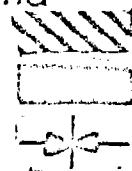
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Project No. B-343  
 Project Title Mobile Homes  
 Project Director Harry L. Stiltz



OCT. 1, 1968  
ON SCHEDULE

# Legend



Part-Time

Full Time

Project Director

## Meetings

1. N. C. State
2. Ga. Tech
3. N. C. State
4. Ga. Tech

PHASE I

PHASE II

PHASE III

NOTE: The second year of the project (July 1, 1969-June 30, 1970) will consist of repeating Phases II & III during the first 9 months, followed by 3 months of statistical analysis and data preparation. Two meetings each, at N.C. State & Ga. Tech are anticipated during the second year.